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STUDIES IN THE ACHATININAE, A GROUP
OF AFRICAN LAND SNAILS

BY JOSEPH C. BEQUAERT

WITH EIGHTY-ONE PLATES

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INTRODUCTION

Several years' acquaintance with the Achatinidae (or subfamily Achatininae, as some prefer), both in the laboratory and in their native African haunts, aroused the desire to write a Monograph that might do justice to these beautiful snails, which comprise the largest known living terrestrial mollusks. This project began to assume more concrete form about 1933, when I obtained a grant-in-aid from the Milton Research Fund of Harvard University. It enabled me to visit the more important European collections for the purpose of studying the type specimens of earlier malacologists. I have also had the opportunity of seeing most of the Achatinidae in the North American museums.

The writing and publication of a complete revision of all Achatininae, as a single work, is a task of such magnitude that I could hardly anticipate completing it at present with the limited time available for malacological studies. In order to ensure that at least part of my observations may be used by other students, it seems advisable to publish it by sections, as opportunity arises. In the present installment I shall deal primarily with certain species which were the object of recent anatomical studies by Dr. A. R. Mead or of ecological field work by Dr. F. X. Williams. In order to provide reliable names for these species it was necessary to revise their characters and synonymy and those of their close relatives. These investigations eventually led me to a comprehensive classification of the known species of *Achatina* and *Archachatina*.

I was fortunate to observe and collect several species during the past forty years on my journeys in Tropical Africa. It is my belief that field observations on any group of animals, not only furnish the basis for an understanding of their ecology, but also help considerably in tracing taxonomic relationships and in evaluating the extent of intra-specific variation. In addition I have had before me unusually large series collected by several of my colleagues, particularly by Dr. A. R. Mead in West Africa, and by Mr. A. Loveridge and Dr. F. X. Williams in East Africa. Material was studied from the following museums: Museum of Comparative Zoölogy (cited as M.C.Z.), United States National Museum (U.S.N.M.), Academy of Natural Sciences of

Philadelphia (Ac.N.S.Phila.), American Museum of Natural History, New York (A.M.N.H.), Carnegie Museum, Pittsburgh (Carn.M.), Chicago Natural History Museum (Chic.M.), Museum of Zoology of the University of Michigan (M.U.Mich.), Bernice P. Bishop Museum, Honolulu (Bish.M.), British Museum (Natural History) (Brit.M.), 's Rijksmuseum at Leiden (Leid.M.), Natura Artis Magistra in Amsterdam (Amst.M.), University Zoological Museum at Copenhagen (Copenh.M.), Naturhistoriska Riksmuseum at Stockholm (Stock.M.), Zoological Museum at Berlin (Berl.M.), the Hamburg Museum (Hamb.M.), Senckenberg Museum at Frankfurt (Frankf.M.), Royal Natural History Museum at Brussels (Brus.M.), Congo Museum at Tervuren (Terv.M.), and National Museum of Natural History at Paris (Par.M.). In addition I had the privilege of examining the private collections of S. Putzeys, P. Dautzenberg, and M. Connolly, all three since deceased.

Measurements. I have followed with slight modifications the method of my earlier paper on the Strophocheilidae. All dimensions were measured to the half-millimeter only. Whenever sufficient material was available, I have attempted to show how extremes in size and shape are connected by intermediate sizes. It should be noted that, like all large snails, the Achatininae tend to produce occasional giants and dwarfs, which are invariably pounced upon to erect new "rare" species, the boon of dealers and the pride of collectors, but likely to confuse the student of variation and relationship for many years after. It is doubtful whether such specimens ever are of more taxonomic importance than sinistral, umbilicate and other abnormalities. The *length* (or height) is that of the longest vertical axis of the shell, from the tip of the spire to the basal edge of the outer lip. The *greatest width* is the largest diameter in front view, measured at right angles to the vertical axis, from the left margin of the body-whorl to the extreme outer edge of the outer lip. In the aperture, the *length* is the longest obtainable distance from the insertion of the outer lip on the parietal wall to the basal edge of the outer lip; the *width* is measured at right angles to the length as the greatest distance from the inner edge of the columella to the outer lip or to the outer margin of the rim, if the latter is expanded. This seems to be the only practical method of determining the width of the aperture in the Achatininae, which do not show any particular outer accretions on the lip after full adult size is reached. When the lip thickens in old age, it is by additions to the inner layer of the margin and does not change the total width of the aperture.

Bibliography. The bibliographies for the several species and subspecies are arranged chronologically. An attempt has been made to

make them as complete as possible. With very few exceptions the references have been verified with the original publications. Particular pains have been taken to determine the actual date of publication, which immediately follows the author's name in each citation. References listed in square brackets are to vernacular or nude names or to publications without standing in binomial nomenclature. Many of the references are no doubt of little or no importance; but in the process of collecting them, some interesting and valuable information was brought to light in obscure publications.

I have reproduced the original descriptions of all newly named forms, either as printed if they were in English or Latin, or in translation if they were in some other language. This seemed essential for an understanding of my interpretation of the several names. It will also allow future students to agree or disagree with my conclusions. For the same reason I have included in my illustrations copies of most of the original figures or, whenever possible, photographs of the older types. Words inserted in square brackets in the original descriptions or elsewhere, were added by myself for needed explanation. This includes the metric equivalents of other measures of length.

ACKNOWLEDGMENTS

The present study of *Achatina* and *Archachatina* is primarily intended to provide the necessary taxonomic basis for the anatomical researches of Dr. A. R. Mead and the ecological field observations of Dr. F. X. Williams. These are published as two separate articles in the same volume of the Museum Bulletin, following the present paper. Much of the East African material on which Dr. Mead's and my own work are based was obtained by Dr. F. X. Williams during investigations sponsored by the Insect Control Committee for Micronesia of the Pacific Science Board of the National Research Council. The United States Navy and particularly the Office of Naval Research not only provided the funds and transportation for Dr. Williams' field work but were also most efficient and helpful in delivering live material for dissection. The same Government agencies made it possible, through appropriate grants, to illustrate and publish in their present form the three papers, covering the taxonomy, anatomy, and ecology of *Achatina*. These advantages were obtained chiefly through the steady interest shown in the *Achatina* work by Mr. Harold J. Coolidge, to whom the authors are under great obligations.

I am particularly indebted for information, photographs and other assistance to my friends and colleagues here and abroad, the late

Major M. Connolly, Mr. T. Pain (in London), Dr. Harald Rehder and Mr. R. Tucker Abbott (at the U. S. National Museum), Dr. H. A. Pilsbry and Mr. C. W. Wurtz (at the Philadelphia Academy of Natural Sciences), Mr. John Armstrong and Mr. F. Weir (at the American Museum of Natural History), Dr. E. Fischer-Piette (at the Paris Museum), and Dr. H. Mermod (at the Geneva Museum). As usual, my colleagues at the Museum, Mr. W. J. Clench and Miss Ruth Turner, have helped me in every possible way with routine matters and with critical advice. Unless otherwise indicated, photographs were made by Mr. F. P. Orchard. I owe to the great kindness of Dr. E. Fischer-Piette photographs of Petit's, Bourguignat's, Révoil's, Crosse's and Germain's types, several of which had not been figured before. Some of these types are part of the collections of the Paris National Museum; others are in the collection of the "Journal de Conchyliologie," at present in the custody of Dr. Fischer. I acknowledge my indebtedness also to the Trustees and Authorities of the British Museum (Natural History) for contributing the photographs of types reproduced in Pl. 81, and to Dr. W. J. Rees, Assistant Keeper of Mollusca, for kindly supervising the making of these photographs.

Genus *ACHATINA* Lamarck

The genus *Achatina* comprises in the present paper all Achatininae with the base of the columella more or less truncate (as a rule distinctly, rarely rather weakly), a conical, pointed spire with a narrow apex, and a simple outer lip, usually sharp and thin, more rarely thickened, never reflexed, although in some species slightly expanded or flaring at the base. The nepionic (or embryonic) whorls, formed in a small egg (9 mm. or less in length), are comparatively narrow, either mostly granulose or smooth. All species are normally dextral.

Achatina is endemic throughout continental Africa south of the Sahara. As known at present, its northern limits are Gambia (14° N.) in the West, the region of Lake Chad (about 14° N.) and the southern Anglo-Egyptian Sudan (about 8° N.) in the center, and southern Abyssinia (about 7° 30' N.) and Somaliland (about 5° N.) in the East. These limits are as yet approximate, as some of the published records from the Sudan are open to question, being possibly based on dead shells carried beyond the true range by man or even on shells bearing erroneous localities. In South Africa the genus extends to the Orange River on the West Coast and to the District of George on the South Coast of Cape Province. One species has been found occasionally introduced near Cape Town, but has not become established. *Achatina*

does not occur with certainty in any of the islands of the Gulf of Guinea. It appears to be indigenous in the smaller islands close to the East African coast, including the Island of Zanzibar. Its presence in Madagascar may be due to relatively recent introduction by man, as both species of the genus now found there live also on the East African mainland. The genus was certainly carried by man to Mauritius, Comoros, Réunion and Seychelles. Its recent further spread by man to India, the East Indies, the Orient and the Pacific Islands is more fully considered in the discussion of *A. fulica*.

Subgenera of Achatina. Numerous trivial names have been proposed in combination with the generic term *Achatina*. Many of these should be referred to other genera, some of them not now included in the family Achatinidae. Others should be relegated to the synonymy or reduced to less than specific rank. Such revaluation leaves nevertheless a fairly large number of valid species in *Achatina*, even as here restricted, with the definition given above. While their total number is difficult to determine at present, I surmise that it will be somewhere between 65 and 80.

It is both desirable and practical to subdivide this rather large aggregate into natural groups, which may be conveniently treated as subgenera. I propose to accept eight of these, based on characters seemingly of more than specific value, and possibly indicating main trends of evolution within the genus. I stress in the first place the presence or absence of granulose sculpture on the nepionic shell or protoconch, formed within the egg. I also use to some extent the sculpture of the post-nepionic whorls, the structure of the columella, the shape of the aperture and the general outline of the shell. Whether or not the anatomy of the soft parts will support this classification must be left an open question for the present. Only a few species, belonging to three subgenera, have been examined in this respect and some of them very superficially.

In view of the importance which I attach to the sculpture of the nepionic whorls, it should be emphasized that, unless the earliest whorls are clearly granulose in the adult, this character must be studied in very young, preferably newly hatched shells. Where such early stages are not available or have never been examined, the species must sometimes be placed provisionally with what appear to be its closest relatives, particularly if the earliest whorls are smooth or lacking. Robson's statement (1921, Proc. Zool. Soc. London, p. 264) that "examination of a number of examples in the British Museum Collection has made it clear that the sculpture of the embryonic whorls of these forms [the Achatininae] differs in individuals of the same species," is no doubt correct for *adult* shells. Yet it does not

impair the value of this character for purposes of classification. A similar difficulty is encountered in the families Strophocheilidae and Bulimulidae, where the type of sculpture of the nepionic whorls is now generally accepted as a valuable character, even though it is often partly or wholly lost in adult shells. It should also be noted that in certain species of Achatininae with a granulose nepionic shell, part of the very first whorl may lack the characteristic sculpture even in newly hatched snails. Moreover, the number of nepionic whorls is not necessarily the same for all subgenera or species, so that one should not merely compare the same number of whorls of different species. It is usually possible to trace the extent of the embryonic shell on immature or adult specimens, the limit being as a rule indicated by a superficial vertical break in the texture of the shell, frequently by the first color markings, or, in the case of species with smooth nepionic whorls, by the appearance of granulation on the post-nepionic whorls.

Cochlitoma, the oldest name proposed for a segregate of *Achatina*, is here regarded as not separable from the subgenus *Achatina*, proper, since the type of the latter, *A. achatina*, does not differ in the sculpture of the nepionic whorls of young shells from the type of the former. In both cases the earliest whorls are granulose, but they are worn smooth in older shells in *A. achatina*. There are, however, several species of *Achatina* with a smooth shell even in the newly hatched young, while some at least of the succeeding whorls are decussate or granulose. These species are here grouped in a distinct subgenus *Lissachatina*. Bourguignat (1889) made the first formal attempt at subdividing *Achatina*; but only two of the four groups for which he proposed names are here accepted with subgeneric status. *Leptocala*, originally introduced as a genus under the name *Petitina* by Jousseaume (1884), is here given subgeneric rank, following Pilsbry's example; while *Euathrips* Clench and Archer (1930) is similarly degraded. It should also be pointed out that some of the South and East African species placed by Pilsbry (1904, *Man. of Conch.*, (2), 17, pp. 66-104) in *Cochlitoma*, are in the present paper removed to *Archachatina*, where they form a new subgenus.

1. Subgenus ACHATINA, proper

Achatina Lamarck, 1799 (An VII), *Mém. Soc. Hist. Nat. Paris*, p. 75. Monotypic for *Bulla achatina* Linné, 1758.

Achatina Latreille, 1804, *Nouv. Diet. Hist. Nat.*, 24, *Tabl. Méthod.*, p. 113 (misspelling of *Achatina*; same type; with description, but without species).

Achatium Link, 1807, *Beschr. Naturh.-Samml. Rostock*, 3, p. 137 (for several

- species). Type by designation of Pilsbry, 1919, *The Nautilus*, **32**, p. 98: *Achatium elegans* Link, 1807 [= *Achatina achatina elegans*], one of the species originally included.
- Helix* subg. *Agathina* Férussac, 1807, *Essai Méthod. Conchyl.*, p. 49 (probably an emendation of *Achatina*). Type by present designation: *Bulla achatina* Linné, 1758, one of three species originally included.
- Achatinus* Denys de Montfort, 1810, *Conch. Syst.*, **2**, p. 418 (here based on an unlabelled figure possibly of *Achatina panthera* Férussac) and 419 (type here said to be *Achatinus zebra* = *Bulimus zebra* Bruguière, 1792). According to Opinion 120 of the International Commission of Nomenclature (1931, *Smithson. Misc. Coll.*, **73**, No. 7, p. 29), *Achatinus* was an emendation of *Achatina*, hence an objective synonym of the latter.
- Agathina* "Lamarck" Deshayes, 1831 (Plate dated May 1830), *Mag. de Zool.*, **1**, Part 1, Class 5, Moll., p. 3 of letterpress to Plate 3, where the name is printed *Achatina* (misspelling of *Achatina*, with same type).
- Achantina* "Sw. et Grun." Deshayes, 1842, *Dict. Univ. Hist. Nat.*, **1**, p. 69 (without definition or species; misspelling of *Achatina*; same type).
- Achatinum* "Mus. Berl." J. E. Gray, 1859, in *Mrs. M. E. Gray, Figures Moll. Anim.*, **4**, p. 116 (as a synonym of *Achatina*; same type).
- Chersina* [Humphrey, 1797, *Museum Calonnianum*, p. 62; ruled to be not available for purposes of nomenclature] Férussac, 1821 (May 26), *Tabl. Syst. Moll.*, *Tabl. Limaçons*, pp. 49-50 (or 53-54) (in the synonymy of four species). Type by designation of Kennard, 1942, *Proc. Mal. Soc. London*, **25**, pt. 3, p. 113: *Bulimus zebra* Bruguière, 1792, one of the species mentioned by Férussac in combination with the name *Chersina*.¹
- Helix* subg. *Cochlitoma* Férussac, 1821, *Tabl. Syst. Moll.*, *Tabl. Limaçons*, p. 48 (or 52) (for several species). Type by designation of Pilsbry, 1904, *Man. of Conch.*, (2), **17**, p. 77: *Bulimus zebra* Bruguière, 1792, one of the species originally included, herewith restricted to Férussac's *Helix* (*Cochlitoma*) *zebra* "Chemnitz" (with reference to Chemnitz, **9**, Pl. 118, fig. 1014).²
- Oncaea* Gistel (or Gistl), 1847, *Handbuch Naturgeschichte Drei Reiche*, (1850), p. 550 (without description or species; a substitute name for *Achatina*); 1848, *Naturgeschichte d. Thierreichs*, p. 168 (with brief description;

¹ As *Bulimus zebra* Bruguière, 1792, was a composite species, which included both the South African *Achatina zebra* of modern authors and *Achatina fulica* Bowdich, it may be worthwhile to designate herewith more definitely as type of *Chersina* Férussac, *Helix* (*Cochlitoma*) *zebra* "Chemnitz" Férussac (1821, with reference to Chemnitz, **9**, Pl. 118, fig. 1014), which is the South African species. If *Chersina* Férussac were rejected for some technicality, the name would have to be dated from Beck (1837, *Index Moll.*, pt. 1, p. 74; as *Achatina* subg. *Chersina*). The type of this was designated by Clench (1946, *Oec. Papers Moll. Dept. M.C.Z.*, **1**, No. 10, p. 121) as *Bulla virginea* Linné, not one of the Achatininae. Moreover, *Chersina* Beck, 1837, would be a homonym of *Chersina* Gray, 1831, in *Reptiles*. Pilsbry's earlier designation (1919, *The Nautilus*, **32**, p. 98) of *Bulla achatina* Linné was for *Chersina* Humphrey, which has no standing in nomenclature.

² Kennard (1942, *Proc. Mal. Soc. London*, **25**, pt. 3, p. 113) claims that, because Férussac first introduced the name *Cochlitoma* in the "Tableau Synoptique" of his "Tableau des Limaçons" (p. 24 or 28), with a definition but without mentioning a species, it was stillborn and automatically a synonym of the older name *Achatina*, with the same genotype. I am unable to follow this line of reasoning, since Férussac not only defined the subgenus, but later in the same work included also several described species. See also H. B. Baker, 1946, *The Nautilus*, **59**, p. 118. The matter is fortunately of little practical importance, since I do not regard the South African *A. zebra* as generically or subgenerically separable from *Achatina achatina* (Linné).

- several described species included). Type by designation of Pilsbry, 1919, *The Nautilus*, **32**, p. 99: *Achatina perdix* Lamarck, 1822 = *Bulla achatina* Linné, 1758, one of the species originally included. Not *Oncaea* Philippi, 1843.
- Geodes* Gistel (or Gistl), 1848, *Naturgeschichte d. Thierreichs*, p. viii (without description or species; a substitute name for *Achatina*). Type by designation of Pilsbry, 1919, *The Nautilus*, **32**, p. 99: *Bulla achatina* Linné, 1758.
- Euachatina* Shuttleworth, 1856, *Notitiae Malacologicae*, **1**, p. 33 (without description; intended to cover the true *Achatinae*, as distinguished from the *Limicolariae*, *Achatina perdix* and *A. marginata* being cited). Type by present designation: *Achatina perdix* Lamarck, 1822 = *Bulla achatina* Linné, 1758.
- Achatina* subg. *Urceus* Mörch, 1857, *Cat. Conch. Suenson*, p. 6 (without description; for 4 species: *A. variegata* de Roissy, *A. purpurea* Lamarck, *A. knorrii* Jonas, and *A. fulminea* Lamarck). Type by present designation: *Achatina variegata* Lamarck, 1801 (de Roissy, 1805) = *Bulla achatina* Linné, 1758.
- Urceus* "Klein" H. and A. Adams, 1858, *Gen. Rec. Moll.*, **2**, p. 658 (as a possible substitute for *Achatina* Lamarck). Type by designation of Pilsbry, 1919, *The Nautilus*, **32**, p. 99, and by present designation: *Bulla achatina* Linné, 1758. [*Urceus* Klein, 1753, *Tentamen Ostracologicae*, p. 46, is pre-Linnean and without standing in nomenclature].
- Parachatina* Bourguignat, 1889, *Moll. Afr. Equat.*, p. 73 (for *Achatina thomsoni* Smith, *A. dohrniana* Pfeiffer, and *A. welwitschi* Morelet). Type by designation of Pilsbry, 1904, *Man. of Conch.*, (2), **17**, p. 17: *Achatina dohrniana* Pfeiffer, 1870.
- Serpaea* Bourguignat, 1889, *Moll. Afr. Equat.*, pp. 74 and 85 (for *Achatina hortensiae* Morelet, *A. dammarensis* Pfeiffer, *A. knorrii* Jonas [misspelled *knori*], *A. varicosa* Pfeiffer, *A. obesa* Pfeiffer, and *A. pinto* Bourguignat). Type by designation of Pilsbry, 1904, *Man. of Conch.*, (2), **17**, p. 24: *Achatina hortensiae* Morelet, 1866.

Ampulla "Bolten" Röding, 1798, is not listed in the foregoing synonymy of *Achatina*, although it originally included, among other species, *Bulla achatina* Linné. Pilsbry (1908, *The Nautilus*, **22**, p. 83), however, designated *Achatina priamus* "Bolten" (a species of *Halina*) as the type, it would seem validly. This designation was evidently overlooked by Winckworth (1945, *Proc. Mal. Soc. London*, **26**, pts. 4-5, p. 137) when he proposed selecting *Ampulla zebra* Röding as the type of *Ampulla*.¹

Acathina Say, 1817, *Achatinia* Swainson, 1821, and *Agatina* (or *Agathina*) Rafinesque, 1831, although possibly misspellings or emendations of *Achatina*, did not as originally proposed or used include

¹ *Ampulla zebra* Röding, 1798, was based only on Chemnitz, 1786, *Syst. Conch.-Cab.*, **9**, pt. 2, Pl. 118, fig. 1014, which represents the South African *Achatina zebra* (Bruguère, 1792). It is not a synonym of *Buccinum zebra* Müller, 1774, as Winckworth implies.

any species now placed in Achatinidae. For this reason I do not list these variants among the synonyms of *Achatina*.

Most of the names listed above in the synonymy of *Achatina* were proposed without descriptions, hence call for no further discussion. *Parachatina*, however, was introduced by Bourguignat for species previously placed in *Achatina*, "characterized by the lack of columellar truncation, the truncation being replaced by a tubercular protuberance." This character does not have the importance attributed to it by the author. In *A. dohrniana*, later selected as the type, the columella does not have a "tubercular protuberance", but is merely more twisted and somewhat less and more obliquely truncate than in the closely related *A. iostoma* Pfeiffer, *A. bandeirana* Morelet, *A. balteata* Reeve, and *A. stuhlmanni* v. Martens (= *rugosa* Putzeys). Of the other species mentioned by Bourguignat, *A. welwitschi* Morelet is extremely close to *A. dohrniana*, if at all distinct. Both *A. dohrniana* and *A. welwitschi* have granulose nepionic whorls, like the other species of the subgenus *Achatina*, proper. *A. thomsoni*, however, belongs in a different subgenus with smooth nepionic whorls, being closely related to *A. allisa* Reeve. Neither *A. welwitschi* nor *A. thomsoni* show any trace of a "tubercular protuberance" on the columella, which is moreover obliquely truncate.

Bourguignat's genus *Serpaea* was intended "for the small globose species," and was later (p. 85) defined "by the shortened shape, ovoid-ventricose or almost spherical, with the shell thin and transparent." The species he included were a heterogeneous lot, *A. knorrii* being an *Archachatina*, while *A. obesa* is a subspecies of *A. zebra*, which Bourguignat left in *Achatina*, proper. *A. hortensiae*, later selected as the type of *Serpaea*, although smaller, more obese and lighter than most *Achatinae*, agrees with *A. achatina* in all essential characters, including the shape of the apex and the granulose nepionic whorls. There is so much variation in the general outline of the shell among the large and medium-sized East and South African *Achatinae*, even sometimes within specific limits, that I have been unable to use this character for a natural or practical grouping of the species. It should also be pointed out that if the need were ever felt to segregate subgenerically these South and East African species, the generic name *Cochlitoma* Férussac (1821) might be available for at least some of them.

Achatina, proper, as here restricted, comprises large to medium-sized species, with a broadly ovate, elongate ovate or subglobular shell, and a regular conical spire, the summit a bluntly angular cone, not narrowly drawn out at the tip. The nepionic whorls, when intact, as in newly hatched shells, are almost entirely covered with granulations in closely set, regular, spiral and vertical rows. Later whorls

have either granulose, decussate, wavy or striate sculpture, or are almost smooth.

Of the species of which I was able to study specimens, the following belong in this subgenus. In most cases the granulation of the nepionic shell was determined either on very young shells or on adults with unworn apex. A few species, mentioned in each case, were included in the list on the basis of obvious relationship with others. They should be studied again on better material.

1. *A. achatina* (Linné, 1758). See below.
2. *A. balteata* Reeve, 1849. See below.
3. *A. bandeirana* Morelet, 1866.
4. *A. bisculpta* E. A. Smith, 1878. Position doubtful.
5. *A. dammarensis* Pfeiffer, 1870 (Synonym: *A. schinziana* var. *degenerata* O. Boettger, 1910).
6. *A. dohrniana* Pfeiffer, 1870.
7. *A. hortensiae* Morelet, 1866.
8. *A. iostoma* Pfeiffer, 8154.
9. *A. natalensis* Pfeiffer, 1855 (Synonym: *A. occidentalis* Pilsbry, 1904).
10. *A. paivacana* Morelet, 1866. Position doubtful.
11. *A. schinziana* Mousson, 1887; with subsp. *passargei* v. Martens, 1900.
12. *A. schweinfurthi* v. Martens, 1873; with subsp. *buchneri* v. Martens, 1882 (Synonyms: *A. schweinfurthi* subsp. *rhodaeme* Pilsbry, 1919; *A. s. r.* "mut." *rhodostemma* Pilsbry, 1919; and *A. s. r.* "mut." *levior* Pilsbry, 1919); subsp. *okapia* C. R. Boettger, 1927; and subsp. *semifusca* Spence, 1923.
13. *A. smithii* Craven, 1881 (Synonym: *A. scaerola* Melvill and Ponsonby, 1893, a sinistral specimen). Position doubtful.
14. *A. stuhlmanni* v. Martens, 1892.
15. *A. tavaresiana* Morelet, 1866 (Synonyms: *A. studleyi* Melvill and Ponsonby, 1897; *A. greyi* da Costa, 1907).
16. *A. tincta* Reeve, 1842; with subsp. *oblitterata* Dautzenberg, 1891.
17. *A. tracheia* Connolly, 1929. Position doubtful.
18. *A. varicosa* Pfeiffer, 1861.
19. *A. welwitschi* Morelet, 1866.
20. *A. weynsi* Dautzenberg, 1900; with "mut." *rosaxis* Pilsbry, 1919.
21. *A. zebra* (Bruguière, 1792); with subsp. *fulgurata* Pfeiffer, 1853; subsp. *kraussii* Reeve, 1842; subsp. *linterac* G. B. Sowerby, 1890; subsp. *obesa* Pfeiffer, 1854; subsp. *tigrina* Beck, 1837 (Synonym: *A. indotata* Reeve, 1849); and subsp. *zebroides* E. A. Smith, 1878.

West African Species of *Achatina*, Proper

In West Africa proper or Upper Guinea, that is in the more or less forested area extending some distance from the Coast between the Senegal and Mt. Cameroon, the genus *Achatina* is seemingly represented by only two species, *A. achatina* (Linné) and *A. balteata* Reeve. Of the other species described or reported from this area from time to time, some are synonyms or intraspecific variants of *A. achatina* or *A. balteata* and will be discussed as such in the sequel. The remainder are either misidentifications or erroneous locality records, as shown presently.

Achatina acuta Lamarck (1822; supposedly from "Sierra Leone"). The type, in Lamarck's Collection at the Geneva Museum, is a specimen of typical *A. fulica* Bowdich, as shown in the discussion of that species.

Achatina albicans Pfeiffer (1853; from "West Africa"). According to the holotype, seen at the British Museum in 1933, this is a species of Angola.

Achatina allisa Reeve (1849; supposedly from "Cape Palmas"). The figured holotype and one paratype were seen at the British Museum in 1933, and are of an East African species discussed in the sequel.

Achatina fulgurata Pfeiffer (1853; supposedly from "West Africa"). The figured holotype and one paratype, seen at the British Museum in 1933, belong to a race of the South African *A. zebra* (Bruguère).

Achatina glutinosa Pfeiffer (1854; supposedly from "West Africa"). According to the holotype, seen at the British Museum in 1933, this is a fairly common East African species, later redescribed as *Achatina petersi* v. Martens (1860). I saw the type of the latter at the Berlin Museum in 1933.

Achatina hamillei Petit (1859; supposedly from the "West Coast of Africa, probably the region of Gambia"). This is in my opinion the common continental East African form of *A. fulica* Bowdich, to be discussed at length in the sequel.

Achatina immaculata Lamarck (1822; without locality). Mörch (1852, Cat. Conch. Yoldi, 1, p. 21) listed it from "Senegal", where no species of *Achatina* is now known to occur. One of Lamarck's types, now at the Geneva Museum, is shown on Férussac's Plate 127 (Atlas to Hist. Nat. Moll. Terr. Fluv.; Plate published in 1823 in Livr. 20, with name "*Helix* (*Cochlitoma*) *immaculata*" in an accompanying printed explanatory sheet). According to information supplied by Dr. G. Mermod, this appears to be the East African species later described by Ancey (1894) as *Achatina marici*.

Achatina indotata Reeve (1849; supposedly from "West Africa"). The type, from the Cuming Collection, examined by me at the British Museum in 1933, is a race of the South African *Achatina zebra* (Bruguière), identical with subsp. *tigrina* Beck.

Achatina obesa Pfeiffer (1854; supposedly from "West Africa"). This is evidently a race of the South African *A. zebra* (Bruguière). Pfeiffer noted that the smaller middle figure of Férussac's Pl. 133 (published by Férussac in 1832 in Livr. 28 of his Hist. Nat. Moll. Terr. Fluv., with the name "*Helix* (*Cochlitoma*) *zebra*" engraved on it) seemed to represent his *obesa*.

Achatina studleyi Melvill and Ponsonby (1897; supposedly from "Old Calabar, Southern Nigeria"). The locality was no doubt erroneous and the specimen came most probably from Angola. A study of the holotype at the British Museum in 1933 failed to disclose characters to differentiate it from *Achatina tavaresiana* Morelet (1866) and *Achatina greyi* Da Costa (1907), with the types of which it was compared. I regard both *studleyi* and *greyi* as synonyms of *A. tavaresiana*, a species found in Angola and adjoining sections of the southern Belgian Congo.

Achatina tinctoria Reeve, a species from the Portuguese and Belgian Congo and northern Angola, is said by Gruvel (1912, Ann. Inst. Océanogr. Monaco, 5, pt. 3, p. 143) to occur in Lower French Guinea at Konakry and particularly in the Los Archipelago (at Tamara), and to be used there as food by the natives. The snail is described as being almost the size of *A. achatina*. No doubt the name *tinctoria* was misapplied through some oversight to a form of *A. achatina*, most probably the subsp. *elegans* (Link), which Germain (1912) records (as *A. achatina* var. *minima*) from Konakry after specimens collected by Gruvel.

Achatina occidentalis Pilsbry (1904; from "West Africa: Corisco Island", Spanish Guinea). This species is not likely to occur in the section of West Africa considered in the present paper. It presents a baffling problem which I am unable to solve now to my own satisfaction. It was described from a single specimen, which I have examined most carefully at Ac.N.S.Phila. I reached the conclusion that it could not be separated from *Achatina natalensis* Pfeiffer (1855), described supposedly from Natal. While I feel certain that both names refer to the same species, this does not settle the true country of origin. The type of *natalensis*, from the Cuming Collection and presumably collected by Plant in Natal, is at the British Museum, where I saw it in 1933. The M.C.Z. has several examples which agree well with this type, but they are from old collections and without reliable localities. The species has sometimes been misidentified. Connolly, who figured

the type for the first time (1939, Ann. South Afr. Mus., **33**, pt. 1, p. 308; Pl. 11, fig. 3), stated that the only authentic examples he knew were three at the British Museum (including the type), all collected by Plant supposedly at Port Natal and Delagoa Bay; but he added that the correctness of Plant's localities is open to question. It seems strange indeed that this fairly large species was not collected for nearly a century in Natal or elsewhere in South Africa. *A. natalensis* appears to be most closely related to *A. welwitschi* Morelet, from Angola. Both species have the nepionic whorls granulose when unworn, hence belong in subgenus *Achatina*, *sensu stricto*, of my classification. In all probability *A. natalensis* is a West African species and will eventually be rediscovered somewhere in Lower Guinea, that is in the region from Cameroon to the Orange River.

Achatina inaequalis Pfeiffer (1855; supposedly from Fernando Po) is an unfigured species, which has not been recognized since it was first described. The type, from the Cuming Collection, now at the British Museum, is shown in my Pl. 81, fig. 4, and I have examined it in 1933. I am unable to separate it from specimens of *Achatina zebra tigrina* Beck. There is no form even remotely like it in West Africa. The locality "Fernando Po" may safely be regarded as one more of Cuming's errors. It may be noted that the type of *indotata*, likewise from the Cuming Collection, was also stated wrongly to be West African.

ACHIATINA (ACHATINA) ACHIATINA (Linné)

The full-grown shell of the nominate race of *A. achatina* has from seven to eight whorls and is very broadly ovate, with a long and greatly swollen body-whorl comprising most of the bulky shell. The regularly conical, relatively short spire, occupying only about one-fourth of the total length, is considerably narrower than the base and its whorls are only slightly convex. As a result immature shells are relatively more slender than adults. In the smaller races, the full-grown shell is narrower, more elongate-oval, with the body-whorl moderately inflated, while by contrast the spire appears longer and wider. This is true even in subsp. *elegans*, which is merely based on dwarf specimens of typical *achatina*, usually occurring in the same locality with the normal, larger ones. A study of subsp. *elegans* is instructive as showing the connection with typical *achatina* of the more distinctive subspecies *monochromatica*, *togoënsis*, and *bayoli*. The little-known subsp. *bayoli* is the most aberrant of all and may possibly represent a distinct species: it is fusiform or spindle-shaped rather than oval in outline, while the summit of the spire is unusually blunt for an *Achatina*.

Nevertheless, the summit is too narrow to be called dome-shaped, while the sculpture is similar to that of the other forms of *A. achatina*, which has led me to include it in the "form group" ("Rassenkreis") of this species, thus removing it from the genus *Archachatina* where it had been placed thus far.

The sutures are shallow, the upper part of each whorl being flattened against the periphery of the preceding whorl. This subsutural area is covered with coarse vertical folds and as a rule set off by a strong impressed line on the penultimate and body-whorl. The suture itself is finely and irregularly crenulate. On full-grown shells the first two to three whorls are either worn smooth or corroded or show traces only of the granulation which originally covered them (as described below). The succeeding whorls show typically a decussate sculpture of elongate welts, best developed on the penultimate whorl and gradually weaker on the body-whorl, particularly below the periphery; a few traces only of the sculpture remain on the last portion of the body-whorl, behind the outer lip. The welts are produced by the decussation of moderately strong vertical growth-striae by weak or superficial spiral engraved lines, placed rather far apart and at irregular intervals. In some specimens the decussate sculpture is barely indicated. The glazing of the parietal wall is slight, the outer lip sharp and thin and the columella strongly concave, slightly curved upward at the base, which is almost squarely truncate some distance above the lower margin of the aperture.

On newly hatched and very young snails, only the very first whorl is superficially wrinkled or almost smooth; the other nepionic whorls are uniformly and finely decussate-granulose (Pl. 14, fig. 4). The granules are evenly rounded and placed in regular vertical and spiral rows. At this stage the granulose sculpture of the earliest whorls differs in no respect from that of the South African *Achatina zebra* (Bruguière), so that it is not possible to use this character to separate *A. zebra* generically or subgenerically from *A. achatina*. For this reason *Cochlitoma* Férussac (1821), as redefined by Pilsbry (1904), with *Bulinus zebra* Bruguière as the type, cannot for the present be considered as distinct from *Achatina*. The difference in the sculpture of the apex only appears later, after the early whorls are worn smooth or corroded in *A. achatina*; while they usually retain the granulations in full-grown *A. zebra*. The nepionic sculpture of *A. achatina* is frequently well preserved in shells up to 40 or 45 mm. long.

The first post-nepionic whorls are more coarsely granulose than those of the nepionic shell, numerous spiral incised lines cutting the strong vertical wrinkles at regular intervals. The granules do not extend below the periphery, the lower part of the whorls being nearly

smooth with only light growth-striae and a microscopic sculpture like the weave of a fine cloth. From the fifth whorl on the granules gradually change into low, vertical welts, the spiral incised lines being wider, shallower and farther apart. This eventually leads to the sculpture of the penultimate and body-whorl of full-grown shells, described before. In very young shells the periphery is obtusely carinate, but this feature disappears from the fifth whorl on. At first the columella is perfectly straight and merges fairly evenly with the base of the outer lip, with scarcely a trace of truncation, and, as first pointed out by Shuttleworth (1856), with an open, though narrow umbilical slit partly covered by the reflexed outer margin of the columella. When the shell reaches 20 to 25 mm. in length, the columella begins to show a slight curve, as well as a fairly distinct truncation, and both features become more marked as growth goes on. The umbilicus closes much later, traces of the slit persisting in some shells 45 to 50 mm. long.

A. achatina occurs with certainty only in Upper Guinea, that is the northern section of West Africa. Here it has been definitely observed from French Guinea (Konakry), through Sierra Leone, Liberia, the Ivory Coast, the Gold Coast, Togo, and Dahomey, to Southern Nigeria (Nun River). All records in the older literature of its supposed occurrence in Senegambia, Cameroon, San Thomé, Gaboon, and Angola have not been reliably confirmed, and I regard them as erroneous. These territories have all been well explored malacologically in recent years, but have never yielded an authentic locality for living *A. achatina*. Inland it extends farthest in Liberia (to some 180 miles from the Coast) and in the Gold Coast (to some 100 miles).

It is a strictly terrestrial snail, so far as my own observations go, most active at night, and exclusively vegetarian. It inhabits densely forested areas, where it prefers primary rain forest and moist second-growth "bush," being found occasionally also in native plantations. I found it commonly in the large cemetery outside the town of Monrovia. Even in the rain forest of Liberia, which is one of the most humid sections of West Africa, the snail buries for estivation during the drier months (from December to March) in the superficial loose soil and litter. It then closes the aperture temporarily with a white, brittle, calcareous epiphragm, provided with a longitudinal slit and similar in appearance to that made by other estivating Achatininae. It is not considered to be a pest in West Africa, being scarcely abundant enough to damage crops. It shows a predilection for decaying vegetable matter and is often even coprophagous. The natives consider it rather an economic asset, as it is a favorite article of the diet of many of the aboriginal tribes, particularly in Sierra Leone, Liberia and the Ivory Coast. As a result, freshly discarded empty shells may be collected

without much trouble in or near most villages. The snails are usually found crawling on the trails in the early morning. In order to carry the large and cumbersome snail without risk of slipping, a hole is cut in the last whorl some distance from the mouth, so that the shell can be tied onto a rope or creeper. Dead shells picked up in villages often bear this tell-tale mark. The snail is either boiled, after which the animal is readily removed, or sometimes roasted directly in the shell. Empty shells of this species being light, thin and rather fragile, are seldom used for domestic purposes, the heavier and more solid *Archachatina ventricosa*, *A. degneri* and *A. marginata* being much preferred as containers or utensils.

Mating apparently occurs chiefly at night and starts long before the snails reach their maximum size. Two shells found mated in the very early morning, after a heavy rain, on a trail through dense primary rain forest between Nyandamolahun and Vasala, Liberia, February 25, 1944, were 160 and 164 mm. long, of 7 whorls, and apparently not quite full-grown. The eggs are surprisingly small for the size of the snail, broadly oval, dirty yellowish, 8 to 8.7 mm. long and 6.5 to 7 mm. wide in the nominate race, slightly smaller (7 by 5.5 to 6 mm.) in subsp. *elegans*.¹ They are deposited many at a time, in clusters in loose soil.

Wingless physogastric females of a phorid fly, *Wandolleckia achatinae* O. F. Cook, are commonly seen in Liberia running over the foot of *A. achatina*. They feed on the slimy excretion of the snail's skin. The males and early stages of the fly are as yet unknown.

Although *A. achatina* was known at least since the beginning of the Seventeenth Century by naturalists and collectors of curios, its true habitat remained a mystery for a long time. Even Linné shared the belief of his predecessors that it was a marine snail, an error which persisted until Favanne (1780), Bruguière (1792) and Férussac (1821). The correct locality was first given by Chemnitz (1786) as the Gold Coast. Yet Lamarek (1822) thought that it might have come from South America, while Férussac (1821) surmised that it was from Madagascar. Rang (1831) first observed the snail alive in West Africa and gave a description of the animal and the egg.

Synopsis of Subspecies. On size, shape, and color I recognize seven forms of *A. achatina* by names, all being given here subspecific status for nomenclatorial reasons. I found the very large, boldly marked typical form by far the most abundant in Liberia and the Gold Coast. Among several hundred Liberian specimens studied, only one belonged

¹ The egg of *A. achatina* was correctly described by Rang (1831), Standen (1917) and Lamy (1929), for the typical form of the species. The large egg, 25 mm. by 17 mm., claimed by v. Martens (1891, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 33) to be that of *A. achatina*, was obviously that of a species of *Archachatina*.

to subsp. *depravata*, five to subsp. *roscolabiata*, and about a dozen to subsp. *elegans*. I have not collected subsp. *monochromatica*, *togoënsis* and *bayoli* myself and little is known as yet of their true habitat. In some respects these three forms are better defined than the others and it would be of interest to investigate the environmental conditions they prefer, as well as their internal anatomy.

A. Shell large and bulky when full-grown, 150 to 200 mm. long and up to 100 mm. wide. Columella and parietal wall vinaceous-red.

a. Boldly marked with dark chestnut-brown zigzag streaks. Outer lip bluish-white. Typical *A. achatina*.

b. Chestnut-brown zigzag markings as in the foregoing. Outer lip with a broad violaceous-red inner margin. Subsp. *roscolabiata*.

c. Uniformly fulvous-yellow, without darker streaks. Outer lip bluish-white. Subsp. *depravata*.

B. Shell much smaller and relatively narrower when full-grown, 150 mm. or less in length and 85 mm. or less in greatest width.

d. Markings of shell and color of columella, parietal wall and outer lip as in typical form. Ovate in outline, the spire much narrower than the base. Subsp. *elegans*.

e. Uniformly fulvous-yellow, without darker streaks. Columella and parietal wall vinaceous-red. Outer lip bluish-white. Subsp. *monochromatica*.

f. Boldly marked with chestnut-brown zigzag streaks. Columella, parietal wall and outer lip bluish-white. Subsp. *togoënsis*.

g. Boldly marked with rather narrow, widely spaced, straight, vertical dark brown streaks, which are sometimes incomplete or broken up into spots. Outline more fusiform than in the other races, the spire scarcely narrower than the base. Subsp. *bayoli*.

a. Typical *A. ACHATINA*

Pl. 3, fig. 1; Pl. 4, fig. 3; Pl. 8, fig. 4; Pl. 11, fig. 2;

Pl. 13, fig. 4; Pl. 14, fig. 4; Pl. 16, fig. 4; Pl. 39, fig. 3

[*Buccinum exoticum variegatum laevius* Fabius Columna (or Fabio Colonna), 1616, Aquat. et Terr. Animal. Observ., p. xviii, Cap. VIII; Pl. on p. xvi, lower right hand figure (type figure for *Bulla achatina* Linné, 1758). Dollfus and Dautzenberg, 1932, Jl. de Conchyl., 76, p. 308, fig. on Plate (copy of Columna's figure; refer it to *Bulla achatina* Linné)].

[Bonanno (or Buonanno), 1684, Recreatio Mentis et Oculi, p. 137, No. 192; Pl. of Classis 3, fig. 192 (included by Linné among the original references for *Bulla achatina*); 1709, Museum Kircherianum, p. 460, No. 190; Plates of Mollusks, Classis 3, fig. 190 (copy of his 1684 fig.)].

- [*Buccinum parvum, integrum*, etc. Gualtieri, 1742, Index Test. Conch., Pl. 45, upper figure B only, with letterpress (included by Linné among the original references for *Bulla achatina*)].
- [d'Argenville, 1742, La Conchyliologie, p. 270; Pl. 13, fig. E (included by Linné among the original references for *Bulla achatina*)].
- [*Urceus* species 1 Klein, 1753, Tentamen Method. Ostracologicae, p. 47].
- ["Breitwellige *Buccinum*" G. W. Knorr, 1754, Deliciae Naturae Selectae, German Ed. (Nuremberg), 1, p. 54; Pl. B5, fig. 1].
- ["Breede Gevlamde Kink-Hoorn" G. W. Knorr, 1771, Deliciae Naturae Selectae, Dutch Ed. (Dordrecht), 1, p. 26; Pl. B5, fig. 1].
- [Seba, 1758, Rer. Nat. Thesauri, 3, p. 169; Pl. 71, figs. 1-3 and 7-10].
- Bulla achatina* Linné, 1758, Syst. Nat., 10th Ed., 1, p. 728 ("habitat in O. americano"; herewith restricted to Linné's specimen and to the figures cited from Fabius Columna, 1616; Bonanno, 1684; Gualtieri, 1742, upper fig. B only; and d'Argenville, 1742; the figures cited from Gualtieri, 1742, lower fig. B, Lister, 1688, and Klein, 1753, refer in my opinion to *Archachatina marginata*); 1764, Mus. Ludovicae Ulricaе, p. 589 (detailed description of a specimen); 1767, Syst. Nat., 12th Ed., 1, pt. 2, p. 1186 (the new, additional references to Petiver, 1764, and Adanson, 1757, are erroneous); 1771, Natuurlijke Historie, Houttuyn Ed., 1, pt. 16, p. 135. Born, 1778, Rer. Nat. Mus. Caes. Vindobonensis, 1, p. 195. J. S. Schröter, 1779, Geschichte Flusssconchylien, p. 301; Pl. 6, fig. 1. Born, 1780, Test. Mus. Caes. Vindobonensis, p. 208 (in part: form α only; not forms β and γ , nor the figures). J. S. Schröter, 1783, Einleitung Conchylienkenntn., 1, p. 185; 1783, Ueber Innern Bau See-, Erd-, Flussschnecken, p. 40 (inner structure of shell; saw specimens 7 and 6 German inches long). Karsten, 1789, Museum Leskeanum, 1, p. 213 (in part). Gmelin, 1790, in Linné, Syst. Nat., 13th Ed., 1, pt. 6, p. 3431 (in part). Schreibers, 1793, Vers. Vollst. Conchylienkenntniss, 1, p. 92. Turton, 1802 (and 1806, with new title page only), in Linné, System of Nature, Animal Kingdom, 4, p. 355 (in part). Dillwyn, 1817, Descr. Cat. Recent Shells, 1, p. 494. Wood, 1818 (and 1825), Index Testaceologicus, p. 89; Pl. 18, fig. 53. Mawe, 1823, Linnaean Syst. Conch., p. 102. Hanley, 1855, Ipsa Linnaei Conchylia, pp. 210 and 503 (type not in Linné's collection in London). Wood, 1856, Index Testaceologicus, Hanley Ed., p. 95; Pl. 18, fig. 53. Hanley, 1859, Jl. Proc. Linn. Soc. London, Zool., 4, p. 67.
- Buccinum achatinum* O. F. Müller, 1774, Verm. Terr. Fluv. Hist., 2, p. 140 (in part: of the references only those to Fabius Columna, 1616; Bonanno, 1684; d'Argenville, 1742; and Gualtieri, 1742, upper fig. B. Descriptions based on several species of *Achatina*, *Archachatina* and *Limicolaria*).
- [Favanne, 1780, in d'Argenville, La Conchyliologie, 3d Ed., Atlas, Pl. 65, fig. M5 (not a copy of d'Argenville's fig. of 1742)].
- [Chemnitz, 1786, Syst. Conch. Cab., 9, pt. 2, p. 18 (localities given as Guinea and Gold Coast; text in part only; not the figs. 1012-1013, which are subsp. *elegans*; said to be terrestrial)].
- Bulimus achatinus* Bruguière, 1792, Encyclop. Méthod., Vers, 1, pt. 2, p. 358. Bosc, 1802 (An X), Hist. Nat. Coq., 4, p. 117.

- [*Chersina tigrina africana* Humphrey, 1797, Museum Calonnianum, p. 63 (with *Bulla achatina* Linné as synonym). Not binominal].
- Achatina achatina* Lamarek, 1799 (An VII), Mém. Soc. Hist. Nat. Paris, p. 75 (genotype of *Achatina*). Bosc, 1803, Nouveau Dict. Hist. Nat., 1, p. 133; 1816, *Op. cit.*, 2d Ed., 1, p. 201. Gray, 1847, Proc. Zool. Soc. London, (for 1847), p. 177. Pilsbry, 1904, Man. of Conch., (2), 17, p. 9; Pl. 31, fig. 1 (specimen). Germain, 1908, Jl. de Conchyl., 56, p. 100 (Ivory Coast: Bouroukrou). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 64. Gruvel, 1912, Ann. Inst. Océanogr. Monaco, 5, pt. 3, p. 143, fig. 19 (Upper and Lower Dahomey. Togo. Southern Nigeria. Eaten by natives and Europeans). Standen, 1917, Jl. of Conch., 17, pt. 5, p. 160 (egg). Lamy, 1929, Jl. de Conchyl., 73, p. 201 (egg). Roux, 1935, Bull. Soc. Sci. Bretagne, 11, (1934), pts. 3-4, p. 106, fig. 3 (ingestion of chalk). Dartevelle, 1935, Rev. Zool. Bot. Afric., 27, pt. 3, Bull. Cercle Zool. Congolais, 12, pts. 3-4, p. (91) (Ivory Coast). Brunet and Jullien, 1937, Arch. Zool. Gén. Expér., 73, pt. 10, p. 387, figs. III-IV; Pl. 9, figs. 7-8 (heart). Dickinson, 1946, The Aquarium, Philadelphia, 15, p. 152; fig. on p. 151 (living snail in captivity in New Jersey). Andrews, 1948, The Nautilus, 61, pt. 3, p. 95 (oviposition in captivity at Baltimore, Maryland). Hanna, 1948, *Op. cit.*, 62, pt. 1, p. 29. Abbott, 1949, Natural History, New York, 58, pt. 2, p. 71, upper fig. Burton, 1949, Illustrated London News, 214, p. 120, right middle fig.
- Helix (Agathina) achatina* Férussac, 1807, Essai Method. Conchyl., p. 49.
- Helix (Cochlitoma, Achatina) achatina* Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 50 (or 54); 1823, Hist. Nat. Moll. Terr. Fluv., Atlas, Pl. 131, figs. 1-3 (in Livraison 20, with name in Explanation on cover), and Pl. 131A, fig. 1 (in Livraison 21, with name in Explanation on cover); 1832, *Op. cit.*, Atlas, Pl. 131B (in Livraison 28, with name engraved on Plate and also in Explanation on cover).
- Helix (Cochlitoma) achatina* Rang, 1831, Ann. Sci. Nat., 24, p. 30 (common along the entire West African Coast; description of animal and egg).
- Cochlitoma achatina* G. B. Sowerby, 1825, Cat. Shells Earl Tankerville, p. 38.
- Achatina (Achatina) achatina* Germain, 1912, Ann. Inst. Océanogr. Monaco, 5, pt. 3, p. 120 (Dahomey: Abomey), figs. 2A, A' and B (on p. 122; 3 juvenile shells).
- Ampulla flammea* "Bolten" Röding, 1798, Museum Boltenianum, pt. 2, p. 110 (defined by the reference to "Gmel. *Bulla flammea* Sp. 32;" there is no *Bulla flammea* Gmelin, but his Sp. 32 was *Bulla achatina* Linné); 1819, *Op. cit.*, 2d Ed. (by J. Noodt) p. 78.
- Ampulla bombarda* "Bolten" Röding, 1798, Museum Boltenianum, pt. 2, p. 110 (defined by the reference to "Gmel. *Bulla achatina* Sp. 32"); 1819, *Op. cit.*, 2d Ed. (by J. Noodt), p. 78.
- Ampulla lacteae* "Bolten" Röding, 1798, Museum Boltenianum, pt. 2, p. 110 (defined by the reference to "Gmel. *Bulla achatina* Sp. 32"); 1819, *Op. cit.*, 2d Ed. (by J. Noodt), p. 78.
- Achatina variegata* Lamarek, 1801, Syst. Anim. Sans Vert., p. 91 (no locality; new name for *Bulla achatina* Linné). de Roissy, 1805 (An XIII), Hist.

- Nat. Moll., **5**, p. 354. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 249. Reeve, 1849, Conch. Icon., **5**, *Achatina*, Pl. 1, fig. 3 only (Sierra Leone). Jay, 1850, Cat. Shells Coll., 4th Ed., pp. 222 and 223. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 155 (in part); and Expl. of Plates of Atlas, p. 19. Mörch, 1852, Cat. Conch. Yoldi, **1**, p. 20. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 482. Woodward, 1854, Manual of Mollusca, pt. 2, p. 165 and p. 12 of Expl. of Plates; Pl. 12, fig. 22. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer 1857, Syst. Conch.-Cab., **1**, Abt. 13, pt. 1, p. 290 (in part; not the figs.); 1859, Monogr. Helic. Viv., **4**, p. 600. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 201. A. D. Brown, 1861, Cat. Shells Coll., p. 56. Mörch, 1863, Cat. Conch. Lassen, p. 4. Bielz, 1865, Verzeichn. Moll. Conch.-Samml., 3d Ed., p. 23. Haines, 1868, Cat. Terr. Shells Coll., pp. 68 and 69. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 211. Paetel, 1869, Moll. Syst. Cat., p. 80. Woodward, 1871, Manual of Mollusca, 2d Ed., p. 292; Pl. 12, fig. 22 (all subsequent editions reprints of this). Paetel, 1873, Cat. Conch.-Samml., p. 99. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 53. v. Martens, 1876, Monatsber. Ak. Wiss. Berlin, p. 257 (Gold Coast: Accra). Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 271. G. R. Batalha, 1878, Cat. Coll. Conchyl. F. R. Batalha, p. 2. Dohrn, 1878, Jahrb. D. Mal. Ges., **5**, p. 155 (Liberia). G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 145. Kobelt, 1880, Illustriertes Conchylienbuch, **2**, p. 261; Pl. 82, fig. 1. P. Fischer, 1883, Manuel de Conchyliologie, p. 486; Pl. 12, fig. 22. Grasset, 1884, Index Test. Viv. Coll., p. 200. v. Martens, 1886, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 114 (Gold Coast: Abetifi, 150 Kilom. inland, at 700 m.). Martorell y Peña, 1888, Catálogo Colección Conchyl. Mus. Martorell, Barcelona, p. 57. Vignon, 1888, Bull. Soc. Mal. France, **5**, p. 70 (Ivory Coast: Grand Bassam). Schepman, 1888, Notes Leiden Mus., **10**, p. 247 (Liberia: Soforé's Place; St. Paul River). Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 241. Bourguignat, 1889, Moll. Afr. Equat., pp. 72 and 74. Büttikofer, 1890, Reisebilder aus Liberia, **2**, pp. 454 and 481. Stearns, 1893, Proc. U. S. Nat. Mus., **16**, p. 327 (Sierra Leone: Freetown). O. F. Cook, 1897, Science, (N. S.), **6**, p. 886 (Liberia. With *Wandolleckia achatinae* as commensal). Boucard, 1901, Cat. Coll. Coquilles Terr., p. 50. Johnston, 1906, Liberia, **2**, p. 861. Julia E. Rogers, 1908, The Shell Book, p. 275. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. Connolly, 1928, Ann. Mag. Nat. Hist., (10), **1**, p. 540 (Sierra Leone: Freetown). Coen, 1945, Catalogo Gasteropodi Polmonati Coll. Coen, p. 42.
- Achatina (Achatina) variegata* Beck, 1837, Index Moll., pt. 1, p. 75.
- Achatina (Archachatina) variegata* Albers, 1850, Die Heliceen, p. 190.
- Achatina (Achatinus) variegata* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 167; 1879, Nomencl. Helic. Viv., p. 264. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 123.
- Achatina (Urceus) variegata* Mörch, 1857, Cat. Coll. Suenson, p. 6.
- Achatina perdix* Lamarek, 1822, Hist. Nat. Anim. Sans Vert., **6**, pt. 2, p. 127 (description of specimens; with *Bulla achatina* Linné as a synonym).

- Children, 1823, Quart. Jl. Sci., London, **15**, p. 240. Stark, 1828, Elements Natural History, p. 56. Menke, 1828, Synopsis Meth. Moll., p. 16; 1829, Verzeichn. Conch.-Samml. Walsburg, p. 7. de Cristofori and Jan, 1832, Consp. Method. Moll., Pars 1, Fasc. 1, p. 4. Potiez and Michaud, 1835, Gal. Moll. Douai, **1**, p. 130. Jay, 1835, Cat. Shells Coll., p. 31; 1836, *Op. cit.*, 2d Ed., p. 42. Schlüter, 1838, Syst. Verz. Conchyliensamml., p. 8. Deshayes, 1838, in Lamarek, Hist. Nat. Anim. Sans. Vert., 2d Ed., **8**, p. 294. Jay, 1839, Cat. Shells Coll., 3d Ed., p. 58. Hanley, 1840, Young Conchologist's Book Species, p. 36. Pfeiffer, 1841, Symbolae Hist. Helic., **1**, p. 28. Deshayes, 1844, in Lamarek, Hist. Nat. Anim. Sans. Vert., 3d Ed., **3**, p. 374. Leunis, 1844, Synopsis d. Drei Naturreiche, Zool., p. 375. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 165. Porro, 1846, Coll. Mus. Modiol., Moll. Terr. Fluv., p. 17. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 220. Shuttleworth, 1858, Notitiae Malacologicae, **1**, p. 33 (young shell). Fridrici, 1874, Bull. Soc. Hist. Nat. Metz, **13**, p. 184. G. R. Batalha, 1878, Cat. Coll. Conchyl. F. R. Batalha, p. 1. Leunis, 1883, Synopsis d. Thierk., 3d Ed. (by H. Ludwig), p. 888. Martorell y Peña, 1888, Catálogo Colección Conch. Mus. Martorell, Barcelona, p. 56. Rethaan Macaré, 1888, Cat. Coll. Coq. Mme Rethaan Macaré, p. 23. Kennard, Salisbury and Woodward, 1931, Smithsonian. Misc. Coll., **82**, No. 17, p. 21 (Children's type of *Achatina*).
- Achatina* (*Cochlitoma*) *perdix* Menke, 1830, Synopsis Method. Moll., 2d Ed., p. 28.
- Bulimus* (*Achatina*) *perdix* Anton, 1839, Verzeichn. Conch. Samml., p. 44.
- Oncaea* *perdix* Gistel (or Gistl), 1848, Naturgeschichte d. Thierreichs, p. 168.
- Achatina* *perdrix* "Lamarck" Rang, 1831, Ann. Sci. Nat., **24**, p. 30 (as a synonym of *Helix achatina* Linné; misspelling of *perdix* Lamarck). Gould, 1833, Lamarck's Genera Shells, p. 66. A. and J. B. Villa, 1841, Dispos. Syst. Conch. Terr. Fluv., p. 19.
- Achatina* *zebra* Schumacher, 1817, Essai Nouv. Syst. Vers. Test., p. 201 (in part). de Blainville, 1825, Man. Malac. Conch., p. 456; Pl. 40, fig. 1. Not *Bulimus zebra* Bruguière, 1792.
- Achatina* (*Achatina*) *amphora* "Fér." Beck, 1837, Index Moll., pt. 1, p. 75 (Guinea; without description; with a doubtful reference to Seba, 1758, Pl. 71, fig. 1). Jay, 1839, Cat. Shells Coll., 3d Ed., p. 58 (Sierra Leone).
- ?*Achatina fulva* Grasset, 1884, Index Test. Viv. Coll., p. 199 (Ivory Coast: Grand Bassam).

Linné's first description of *Bulla achatina* (1758) was very brief: "B. testa ovata, apertura obovata apiceque sanguineis, columella laevi." It was, however, based on at least one specimen, of which he gives a detailed and recognizable description in Mus. Ludovicae Ulricaе (1764), in addition to a copy of the earlier diagnosis: "Testa magna, ovata, glabra, pellucida, rubra s. alba, fasciis longitudinalibus undulatis fuscis, apice sanguinolento. Apertura magna, figura literae S vel inaequaliter ovata. Labium exterius tenue aequale; interius

longitudinaliter reflexum, adnatum, sanguineum. Basis non emarginata, quamvis obtusa et truncata columella, adeoque dubii generis." I agree with Dollfus and Dautzenberg (1932) that Fabius Columna's (1616) figure, cited by Linné (1758) and copied in my Pl. 11, fig. 2, is the true *Achatina achatina*, as here understood. It shows, not the dwarf race of the species, but an immature shell of the typical form, 71 mm. long, 36 mm. in greatest width, of about 6 whorls. Whether Linné's specimen is still preserved in some Swedish collection, I have been unable to trace. If it were definitely lost, Columna's figure might be selected as the type figure, being the oldest. Of the other references given by Linné, Bonanno's fig. 192 (1684), copied in my Pl. 13, fig. 4, is extremely poor, but seems to be a foreshortened drawing of an immature *A. achatina*, 86 mm. long and 52 mm. wide. Gualtieri's (1742) upper fig. B of Pl. 45,¹ copied slightly reduced in my Pl. 3, fig. 1, is a good representation from the back of a very large *A. achatina*, with a decidedly pointed summit, 178 mm. long, 101 mm. wide (the size may have been exaggerated by the draftsman, although I have seen even larger specimens). d'Argenville's (1742) Pl. 13, fig. E, copied in my Pl. 8, fig. 4, is clearly *A. achatina*, apparently a reduced drawing of the typical race; it is 89 mm. long, 50 mm. wide, of 7 whorls, with the aperture 48 by 24 mm. The remaining figures cited by Linné (1758) are not in my opinion *A. achatina*: Gualtieri's Pl. 45, lower fig. B, represents *Archachatina marginata* (Swainson); Lister's Pl. 579, fig. 34, and the poor copy by Klein, Pl. 3, fig. 60, are *A. marginata suturalis* (Philippi). They are discussed later under these two forms.

Seba's (1758) figs. 1-3 and 7-10 of Pl. 71, one of which is copied in my Pl. 4, fig. 1, are reversed drawings, mostly from the back, of typical *A. achatina*, some adult, others immature.

Favanne's (1780) figure, copied in my Pl. 16, fig. 4, is not, as might be supposed, a copy of d'Argenville's (1742) Pl. 13, fig. E, but represents an entirely different shell, 89 mm. long, 51 mm. wide, of 7 whorls, with the aperture 48 by 25 mm. It is evidently a reduced drawing of an example of typical *A. achatina*.

Röding's (1798) trivial names *bombarda*, *flammea* and *lactea*, though published without descriptions, were validly defined for nomenclatorial purposes by the references to "Gmelin Sp. 32," which makes them straight synonyms of *A. achatina*. Presumably the names were given to specimens in Bolten's collection, but what became of these shells is unknown.

Lamarck first (1801) introduced the trivial name *variegata*, without a description, but as a substitute for *Bulla achatina* Linné, of which

¹ The accompanying description, which covers both upper and lower figs. B, is copied in my discussion of *Archachatina marginata*.

it is therefore a synonym. Later he discarded *variegata* for *perdix* (1822), adding the following description: "A. testa maxima, ovato-oblonga, ventricosa, decussata, alba, apice rosea; flammis longitudinalibus undulatis spadiceis; columella purpureo-violacea; labro intus alba." The French text also stated that "the sutures are slightly crenulate and the shell very prettily ornamented with beautiful reddish-brown flames." At my request, Dr. G. Mermod sent me the following detailed information on the shells now called *perdix* in the Lamarck Collection at the Geneva Museum. That Museum also owns Lamarck's personal copy of the "Histoire Naturelle des Animaux sans Vertèbres" (often called the "Système"), with marginal manuscript annotations by his daughter Rosalie, as noted in a recent paper by Dr. Mermod (1947, Rev. Suisse Zool., 54, p. 158). According to the marginal note relating to *A. perdix*, Lamarck had three specimens. Dr. Mermod describes the three now present as follows (translated from the French, *in litt.*, 1948): "Specimen 1: 124 mm. long, 68 wide; aperture 76.5 mm. long, 38.5 wide; 8 whorls; length of spire (above body-whorl) 57.5 mm.; of next to last whorl, 23.5; of preceding whorl, 13; of next preceding whorl, 4; of combined first three embryonic whorls, 6; outer lip slightly chipped; shell clothed in a brownish golden-yellow periostracum, covered with growth striae, which are very marked toward the suture, forming as it were lengthened granules; elsewhere on the whorls there are about 20 such growth striae over a space of 1 cm.; the spiral striae, not strongly marked though distinct, difficult to count exactly, cut across the growth striae at rather irregular intervals; they are less marked over the base of the body-whorl; the white ground color bears brown zigzag bands, sometimes confluent, especially in the upper part of the whorls; aperture with a well marked parietal callus, dark roseate, like the columella; outer lip sharp, bluish-white like the aperture inside, broadly rounded in its lower (basal) portion; first whorls of spire roseate. Specimen 2: much larger, 154 mm. long, 88 wide; aperture 87 mm. long, 55 wide; 8 whorls; agrees exactly with the foregoing in markings and color; aperture inside with traces of numerals, unfortunately unreadable, as is often the case for Lamarck's shells. I cannot be sure that this is the shell of which Lamarck gives the dimensions, particularly as it is only 154 mm. instead of 162 mm. long.¹ Specimen 3: bears inside a perfectly readable annotation in Lamarck's own hand (not his daughter's), '*A. perdix*,' which escaped former Curators of the Lamarck Collection,

¹ I propose to select this largest specimen as Lamarck's true type of *A. perdix*, as he stated that his largest examples were nearly 6 inches long. Obviously he was satisfied with an approximation and it is unlikely that a specimen would be exactly 6 French inches long. Moreover, in my experience it is by no means easy to make exact measurements of very large shells. A relatively slight deviation from the true vertical may cause a difference of several millimeters. [J. B.]

including Mr. Paul Godet; the latter identified the shell, I believe correctly, as '*Achatina marginata*, Sénégal ou Afrique occidentale,' unfortunately, this shell, polished with a grindstone, is without periostracum; it is 112 mm. long, 70 wide, the aperture 86 mm. long, 39 wide; 7 whorls; although polished, the last 2 whorls show a continuous impressed line at about 2 mm. below the suture; brown bands colored as in the foregoing 2 shells, but more tortuous, zigzagging, close together; margin of outer lip completely covered outside with the confluent brown bands, which is not true at all of the other 2 shells; outer lip in profile much more sinuous, forming a reversed S; mouth inside, parietal callus, and columella white; columella markedly more curved in profile; first 3 whorls of spire very pale brownish, not roseate; summit of spire distinctly more obtuse, which is not due to the polishing, since the sculpture remains quite distinct."¹

Specimens Examined. SIERRA LEONE: Bwedu (J. Bequaert.-M.C.Z.); Mosente on Lake Kwarko, Kwarko Chiefdom (T. S. Jones.-M.C.Z.); Bumpé Chiefdom (T. S. Jones.-M.C.Z.); Njala (T. S. Jones.-M.C.Z.); Freetown (W. H. and A. H. Brown.-U.S.N.M.). — LIBERIA: Harbel (Firestone Plantation), on the Du (or Dukwa) and Farmington Rivers; Monrovia; Memeh Town; Reputa to Kakata; Salala; Dobli Id.; Degei; Jenne; Kailahun; Bolahun; Sardu Pascia; Vasala; Nekaboo; foot of Mt. Wolagwissi at 2,000 ft.; Belleyella; Pandamai; Popolahun; Lukahzu; Bondualahun; Nyandamolahun; Taninewa; Daugomai; Vanyata; Bellepalamu; Kumbacta; Mabossu; Zigida; Lakrata (all by J. Bequaert.-M.C.Z.); Ganta (G. W. Harley.-M.C.Z.); Cape Palmas (U.S.N.M.; M.C.Z.); Bavia (J. Büttikofer.-Leid.M.); St. Paul's River (Amst.M.); Mt. Coffee (Curie.-U.S.N.M.). — GOLD COAST: Suhum near Accra; Bawaleshi near Accra; Yensu near Accra (all by J. Bequaert and A. Mead.-M.C.Z.); Oda, 90 miles N. of Accra (G. S. Cansdale.-Chic.M.; also seen there alive by A. Mead); Nsawam (David Fairchild.-M.C.Z.). — SOUTHERN NIGERIA: Lagos (Ac.N.S.Phila.; M.C.Z.).

Previous records of typical *A. achatina*, with precise localities, were from Sierra Leone, Liberia, the Ivory Coast (Grand Bassam; Bouroukrou), the Gold Coast, and Dahomey (Abomey).

¹ Dr. Mermod notes also that specimens 1 and 2 agree with Pilsbry's Pl. 31, fig. 1 (*Achatina achatina* Linné); while specimen 3 agrees with his Pl. 24, fig. 23 (*Archachatina marginata* Swainson), except for the color of the aperture inside, which is much darker in the figure, and for the columella, which is less curved in the figure. Lamarck's Specimen 3 appears to be an immature *A. marginata*, with a sharp, not yet expanded outer lip, which may explain why Lamarck placed it with his other *A. perdis*. Moreover, *A. marginata* was only recognized as a distinct species by Swainson about the time Lamarck wrote his account of *Achatina*. [J. B.]

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Whorls		
194 mm.	106	111	60	8		Harbel
191.5	99.5	102	54	8		Mt. Coffee
186.5	101	104.5	54	8		"
184	117	100	57	8		Liberia
172	87.5	85	49	7½		Cape Palmas
167	80	86	43	8		West Africa
160	89	86	46	7		Taninewa

The nominate race of *A. achatina* is not only the largest, but also the most capacious terrestrial mollusk now living. The capacity of some of our Liberian specimens reaches 500 to 520 cubic cm. Our largest specimen (194 mm.) comes close to the record length of 200 mm. given by Dohrn (1878), also for a shell from Liberia. This area, with its yearlong high temperature, its protracted heavy rainfall and its luxuriant evergreen vegetation of dense forest, seems to offer the optimum environmental conditions for the species.

An abnormal umbilicate specimen, labelled as from "West Africa" (M.C.Z.), is shown in Pl. 39, fig. 3. It is 115 mm. long and 71 mm. wide.

b. *A. ACHATINA ROSEOLABIATA*, new subspecies

Pl. 1, fig. 1; Pl. 12, fig. 2

Bulla achatina Shaw and Nodder, 1796, Naturalist's Miscellany, 7, Pl. 248 (no date on Pl.; 2 views of immature shell). Not of Linné, 1758.

Size, shape and sculpture of typical *A. achatina*, the color pattern of dark brown wavy or zigzag stripes being the same. In addition to the columella and the parietal wall, the outer lip also is bright violaceous-pink over a wide inner margin, extending sometimes far into the interior of the mouth. Apex of spire more strongly suffused with rose than usual, as far down as the fifth whorl.

Shaw and Nodder apparently figured an immature specimen of this form, with the outer lip rather extensively violaceous within. The pointed spire refers the figures to a form of *A. achatina* and not to one of the purple-mouthed species of *Archachatina*. One of them is copied in my Pl. 12, fig. 2.

Specimens Examined. LIBERIA: Bolahun, holotype, M.C.Z. No. 163513; Jenne, paratype, M.C.Z. No. 163502; foot of Mt. Wolagwissi (about 2000 ft.) near Pandamai, paratype, M.C.Z. No. 163503 (all collected by J. Bequaert).

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Length		
181 mm.	101.5	93.5	52	7 $\frac{1}{2}$		Bolahun; holotype
169	87	92.5	46	7 $\frac{1}{2}$		Jenne; paratype

c. *A. ACHATINA DEPRAVATA*, new subspecies

Pl. 2, fig. 1

Size, shape and sculpture of typical *A. achatina*, but without any trace of dark brown wavy stripes; periostracum nearly uniformly straw-colored, with a few darker narrow vertical zones indicating stages of growth. Apex pinkish; columella and parietal wall vinaceous-red as usual.

Specimens Examined. LIBERIA: Harbel (Firestone Plantation), on the Du (or Dukwa) River, holotype, M.C.Z. No. 77001 (J. Bequaert). — Also one paratype, without locality, Chic.M. No. 525.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Length		
177 mm.	95	92.5	51.5	7 $\frac{1}{2}$		Harbel; holotype
152	85	91	46	7		Paratype

d. *A. ACHATINA ELEGANS* (Link)

Pl. 12, fig. 1; Pl. 14, fig. 1; Pl. 15, fig. 1

Buccinum achatinum var. γ O. F. Müller, 1774, Verm. Terr. Fluv. Hist., **2**, p. 141 (no locality; with description, but no references).

[Chemnitz, 1786, Syst. Conch. Cab., **9**, pt. 2, p. 18 (text in part only); Pl. 118, figs. 1012–1013].

Ampulla achatina Röding, 1798, Museum Boltenianum, pt. 2, p. 110 (with references to Gmelin sp. 32 β and to Chemnitz, Pl. 118, figs. 1012–1013); 1819, *Op. cit.*, 2d Ed. (by J. Noodt), p. 78. Not of Linné, 1758.

Achatium elegans Link, 1807, Besch. Natur.-Samml. Rostock, **3**, p. 138 (defined by the reference to Chemnitz, Pl. 118, figs. 1012–1013).

Helix (Cochlitoma) achatina Férussac, 1823, Hist. Nat. Moll. Terr. Fluv., Atlas, Pl. 131A, figs. 2–3 (in Livraison 21, with name in Explanation on cover).

Achatina perdix Voigt, 1837, Lehrb. d. Zoologie, **3**, p. 396 (with reference to Chemnitz, Pl. 118, figs. 1012–1013). Pfeiffer, 1840, Krit. Register Konch.-Kab., p. 84. Not of Lamarek, 1822.

- Achatina variegata* var. Philippi, 1849, Abb. Besch. Conch., **3**, pt. 5, p. 31 (9 of *Achatina*); Pl. 2 of *Achatina*, fig. 4 (no locality). Reeve, 1849, Conch. Icon., **5**, *Achatina*, Pl. 5, fig. 3b (no locality). Not of Lamarck, 1801.
- Achatina variegata* var. β Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 482 (with reference to Philippi's fig. 4).
- Achatina variegata* var. 1 Pfeiffer, 1857, Syst. Conch.-Cab., **1**, Abt. 13, pt. 1, p. 291 (in part); Pl. 2, figs. 1-2 (copies of Chemnitz's Pl. 118, figs. 1012-1013).
- Achatina chaperti* Ancey, 1888, Bull. Soc. Mal. France, **5**, p. 70, footnote (Ivory Coast: Assinie). Bequaert and Clench, 1934, Rev. Zool. Bot. Afric., **26**, pt. 1, p. 113.
- Achatina achatina* var. *chaperti* Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 64.
- Achatina variegata* var. *minor* Morelet, 1888, Jl. de Conchyl., **36**, p. 99 (no locality; briefly defined by comparison with *A. bayoli* Morelet). Not *Achatina panthera* var. *minor* Deshayes, 1851.
- Achatina variegata* var. *gracilis* Preston, 1909, Ann. Mag. Nat. Hist., (8), **3**, p. 183 (West Africa). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. Schouteden, 1936, Rev. Zool. Bot. Afric., **28**, pt. 4, p. 498 (type from Putzeys' Coll., now at Tervuren Mus.). Not *Achatina sennaariensis* var. *gracilis* v. Martens, 1870.
- Achatina* (*Achatina*) *achatina* var. *minima* Germain, 1912, Ann. Inst. Océanogr. Monaco, **5**, pt. 3, p. 121 (Dahomey: Abomey. French Guinea: Konakry), fig. 1 (specimen from Abomey). Not *Achatina minima* Siemaschko, 1847.
- Achatina tincta* Gruvel, 1912, Ann. Inst. Océanogr. Monaco, **5**, pt. 3, p. 143 (French Guinea: Konakry; Los Archipelago, particularly Tamara. Eaten by natives). Not of Reeve, 1842.

O. F. Müller (1774) seems to have given the first recognizable description of the race *elegans*: "fulva, vel candida, axi sanguineo; long. 4 unc. [Danish inches=104.5 mm.], lat. 1 unc. 9 lin. [=45.5 mm.]" ; and (on p. 142): "Testa in γ fulva (decorticata, candida) pellucida, subrubens, duriuscula, pulcherrime longitudinaliter striata; striae subtilissimae confertae creberrime interruptae, ita ut series lineolarum excavatarum transversalium anfractus cingere videantur. Fasciae latae, undulatae fuscae longitudinales. Faux caeruleascens, fasciis pellucentibus. Solus axis sanguineus."

Chemnitz (1786, p. 20) stated expressly that, in order to save space, he figured of this well-known snail only a pair of medium-sized specimens: one (fig. 1012) covered with the yellowish periostracum, seen from the back, is 85 mm. long, 53 mm. wide; the other (fig. 1013), shown in front view, is polished and denuded, 83 mm. long, 45 mm. wide, the aperture 47 by 27 mm. He added that some of his other specimens were up to 7 German inches (=183 mm.) long, these being of the typical form of the species. Both figures are copied in my

Pl. 12, fig. 1, and Pl. 14, fig. 1. Link may have had a specimen, the present whereabouts of which is unknown; his name is validated in any case by the reference to Chemnitz's figures; of these fig. 1012 is herewith taken as the type figure of *elegans*. Gmelin's *Bulla achatina* β (1790, p. 3432) covers references to figures of typical *achatina*, as well as to Chemnitz's figs. 1012-1013. Philippi (1849) pointed out the similarity between Chemnitz's fig. 1012 and his own shell, which was 93 mm. long, 50 mm. in greatest width, with the aperture 50 by 27 mm. Reeve's (1849) shell, although appearing perfectly full-grown, is one of the smallest known of the species, being only 61 mm. long, 34 mm. in greatest width, the aperture 34 by 18 mm.

Ancey gave no measurements of his unfigured *chapcri*, barely defining it by the statement that it is "always of small size." I have been unable to trace one of his actual types, although I saw some shells, without a locality, at the Brussels Museum which may have come from him.

Morelet's var. *minor* was described incidentally as follows (translated from the French): "The second form [= *minor*], much more ventricose, has a more lengthened and much less obtuse spire; as a result its aperture is more dilated; the color and particularly the ornamentation are very different and although the sculpture is similar in both species, it does not appear the same, since *A. variegata* [var. *minor*] seems to be distinctly rugose to the eye, whereas the other species [= *A. bayoli*], more finely engraved, looks smooth." No measurements were given.

Preston's *gracilis* was very briefly described: "Shell less swollen and proportionately much narrower than is the case with typical *A. variegata*; the whorls are also rather more convex and the painting less regular. Alt. (about) 120, diam. maj. (about) 58 mm." I saw the unfigured type in Putzeys' collection in 1933; it is now at the Congo Museum, Tervuren (Belgium).

The best description published of subsp. *elegans* is that given by Germain for his *minima* (translated from the French): "Shell medium-sized, rather elongate, ovoid; spire of 8 moderately convex whorls, regularly increasing, divided by almost linear sutures; apex obtuse, almost smooth; body-whorl large, with the greatest convexity a little below mid-length; aperture elongate subpyriform, very acute above, broadly rounded below and outwardly, equal to about half the total length of the shell; columella curved inwardly, abruptly truncate at base. The apex is almost smooth; the first whorls show well-marked vertical striae, wrinkled at the sutures, wavy, rather close together, and cut by fine spaced spiral striae; the body-whorl has rather coarse irregular vertical striae, with only a few spiral striae near the suture.

The color is as variable as in typical *A. achatina*." Measurements are given of 5 shells: length respectively 80, 97, 100, 105, and 120 mm.; greatest width respectively 46, 50, 52, 59, and 60 mm.; lesser width respectively 36, 44, 45, 49, and 52 mm.; aperture respectively 44, 53, 56, 53, and 59 mm. long and 22, 27, 28, 30, and 35 mm. wide. The types could not be seen at the Paris Museum in 1933; but some have been traced there since by Dr. E. Fischer, who sent me a photograph of one of them, 120 mm. long, and presented one of these cotypes to the M.C.Z.

Subsp. *elegans* agrees with the nominate race in shape, color and sculpture, differing only in the smaller size for the same number of whorls in adult shells. Often, but not always, the apical whorls are whitish, without any trace of pink. Such dwarfs occur sporadically throughout the range of the species, almost always together with the larger form, seemingly showing no preference either for a particular geographical section or for a special environment. They may predominate, however, in certain localities. They do not seem to intergrade with the large specimens, so that some genetic difference may be involved.

If the name *elegans* is to be rejected owing to some technicality in present or future Rules of Nomenclature, the name *chaperi* Ancy will have to be used instead for this dwarf race.

Specimens Examined. LIBERIA: "Coast of Malaguette" (U.S.N.M.); Bolahun (J. Bequaert.-M.C.Z.); Ganta (G. W. Harley.-M.C.Z.); Suah Koko, ovipositing (J. Bequaert.-M.C.Z.).—DAHOMY: Abomey, cotypes of var. *minima* (A. Gruvel.-Par.M.; M.C.Z.).—SOUTHERN NIGERIA: Oloki Meji, Ibadan (J. C. Bridwell.-Bish.M.; M.C.Z.).—Also several specimens merely labelled "West Africa", including the type of *gracilis* (Terv.M.; M.C.Z.).

There are also reliable records from French Guinea and the Ivory Coast.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
150 mm.	84	76	44	7½	Oloki Meji	
132	70	70	40	7¾	Suah Koko	
115.5	63	66	32	7½	Ganta	
107	56	58	29.5	7½	West Africa	
102	55	57	29	7½	Bolahun	
98	51	53.5	26.5	7½	Abomey	
97	50.5	53	28	7	Liberia	
69	39	39	29	6½	West Africa	

e. *A. ACHATINA MONOCHROMATICA* Pilsbry

Pl. 10, fig. 2; Pl. 13, fig. 1; Pl. 19, fig. 1; Pl. 75, fig. 3

- ? *Bulimus fulvus* Bruguière, 1792, Encycl. Méthod., Vers, 1, pt. 2, p. 359 (no locality; description of a specimen; also a reference to Lister, 1688, Synopsis, Pl. 582, fig. 35a, which, however, is *A. fulica* Bowdich, not Bruguière's *fulvus*). Bosc, 1802 (An X), Hist. Nat. Coq., 4, p. 120.
- Achatina (Achatina) fulva* "Bruguière" Beck, 1837, Index Moll., pt. 1, p. 76 (with reference to Férussac's Pl. 124; no individual figures cited, but figs. 3-4 presumably intended).
- ? *Achatina fulva* Pilsbry, 1904, Man. of Conch., (2), 17, p. 47 (in part: the description translated from Bruguière, but not most of the references).
- ? *Helix (Cochlitoma) fulvescens* Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 49 (or p. 53) (no locality; no description; with *Bulimus fulvus* Bruguière as a synonym, to which I herewith restrict the name; also with a reference to Lister's Pl. 582, fig. 35a, which is *A. fulica* Bowdich).
- Achatina variegata* Reeve, 1849, Conch. Icon., 5, *Achatina*, Pl. 5, fig. 3c (no locality). Not of Lamarek, 1801.
- Achatina variegata* var. β Pfeiffer, 1853, Monogr. Helic. Viv., 3, p. 482 (with references to Reeve's fig. 3c and to Deshayes' Pl. 124, figs. 3-4).
- Achatina variegata* var. 2 Pfeiffer, 1857, Syst. Conch.-Cab., 1, Abt. 13, pt. 1, p. 291.
- Achatina variegata* var. *unicolor* Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., Explanation of Plates in Atlas, p. 18, for Pl. 124, figs. 3-4 (no name on Plate); described without name as a small unicolorous variety in Vol. 2, pt. 2, p. 157. According to Kennard, Pl. 124 was published after Férussac's death by Deshayes, presumably in 1851; but this is seemingly contradicted by Beck's citing it in 1837. Not *Achatina unicolor* C. B. Adams, 1849.
- Achatina cyanea* Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 51 (*nomen nudum*). "Albers" Paetel, 1889, Cat. Conch.-Samml., 4th Ed., 2, p. 239 ("Angola"); no description nor reference. *Nomen nudum*.
- Achatina achatina* var. *monochromatica* Pilsbry, 1904, Man. of Conch., (2), 17, p. 10 ("Angola"); Pl. 32, fig. 3 (type). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 64.
- Achatina (Achatina) achatina* var. *monochromatica* Germain, 1912, Ann. Inst. Océanogr. Monaco, 5, pt. 3, p. 122 (French Guinea: Konakry. Dahomey: Abomey).
- Achatina monochromatica* Bequaert and Clench, 1934, Rev. Zool. Bot. Afric., 26, pt. 1, p. 114.

The description of *Bulimus fulvus* Bruguière (1792), based on a specimen, reads (translated from the French): "Bulimus, testa obovata, fulva longitudinaliter obsolete striata, columella rosea. Differs from the preceding two species [*Achatina zebra* (Bruguière) and *A. achatina* (Linné)] in: (1) the shell, although with the same number of whorls, being a little more elongate and less ventricose; (2) the striae which cover it being all longitudinal [vertical], inconspicuous and without

any trace of transverse [spiral] striae; (3) the aperture being shorter than half the length of the shell, the left [outer] lip being very thin and not colored, while the columella has a beautiful incarnate tint as in the *Bulime perdrix* [*A. achatina*], but a little less deep; finally in the outside color, which is fulvous throughout without any mixture of another color. All other parts of the shell as in the preceding two species." Unfortunately no measurements are given. The first of the two citations, to Lister's Pl. 582, fig. 35a, is clearly erroneous, as this figure represents *A. fulica* Bowdich. It is, moreover, distinctly striped vertically, not unicolorous. Bruguière also cites with doubt O. F. Müller's *Buccinum achatinum* var. *c* [or γ]; but this is described as having vertical undulating fuscous streaks and appears to be *A. achatina elegans* Link. So far as I could trace, Bruguière's type is lost. As pointed out by Pilsbry (1904), his *monochromatica* fits Bruguière's description of *B. fulvus* better than any other known *Achatina*. Although I fully agree with this, I hesitate to introduce the name *fulva* for it. So much is certain, however, that the name cannot be applied to any of the East African *Achatinae*, as Deshayes (1838; 1851) and his successors did. Deshayes' description and the Plate 124, figs. 1-2, of Férussac's Atlas, which he cites in support of it, are of *Achatina fulica*. The pale columella and the markings of the shell could not possibly fit Bruguière's description.

The small unicolorous race of *A. achatina* was well figured by Reeve (1849), his specimen being 96 mm. long, 53 mm. in greatest width, with the aperture 53 by 29 mm. Deshayes' (1851) specimen (Pl. 124, figs. 3-4) is slightly smaller, 83 mm. long, 47 mm. in greatest width, with the aperture 48 by 25 mm. One of Deshayes' figures is copied in my Pl. 75, fig. 3. This form, recognizably described by Pfeiffer in 1853 and 1857, is found in several collections labelled "*cyanea* Albers," a manuscript name published, but not validated by Paetel (1889). I saw Paetel's specimen at the Berlin Museum in 1933 and recognized it as var. *monochromatica* Pilsbry. It now bears the obviously erroneous locality label "Algoa Bay", although Paetel listed it from "Angola."

Pilsbry's description of var. *monochromatica* was presumably based on one of these old specimens: "Shell somewhat smaller [than typical *A. achatina*], white under the smooth and glossy olive-yellow cuticle, which is uniform except for some faintly darker streaks marking growth-stages, and a faint peripheral belt. Suture distinctly margined. Aperture smaller than in *achatina*, colored the same. Length 120, diam. 65, aperture 66 mm." I have seen the type (Ac.N.S.Phila. No. 78483), shown in my Pl. 19, fig. 1. It has 7 whorls and agrees with the measurements given (the original figure is 5 mm. too short). Pilsbry states correctly that this shell meets the requirements of

Bruguère's description of *B. fulvus* better than the East African form (a variant of *A. fulica* Bowdich) which later authors have associated with the name. There is, however, too much uncertainty about the matter to replace the name *monochromatica* by the earlier *fulva*. The lack of any information about the size of Bruguère's shell is particularly disturbing. It would seem strange that the author called attention to the more elongate shape as compared with *A. achatina*, and not to the more obvious size. For this reason the possibility cannot be ignored that his *B. fulvus* might have been a specimen of the large unicolorous race which I describe as *A. achatina depravata*.

Germain (1912) recorded *monochromatica* from French Guinea and Dahomey. I could not see these specimens at the Paris Museum in 1933; but Dr. E. Fischer has recently found the lot from Abomey and has kindly sent me two of them, with permission to retain one for the M.C.Z. These specimens agree in every respect with Pilsbry's type of *monochromatica*, as well as with the similar shells called "*cyanea*" in some collections, being entirely devoid of even traces of wavy dark streaks. At least one exact locality is now known for this race. Whether the shells Germain mentioned from French Guinea also belong here must be left undecided for the present.

Subsp. *monochromatica* includes diminutive adult examples, nearly uniformly yellowish-fulvous or straw-colored, entirely devoid of the usual dark-brown vertical streaks or zigzag markings. Columella and parietal wall are bright rose-colored to purplish when fresh.

Specimens Examined: DAHOMEY: Abomey (A. Gruvel.-Par.M.; M.C.Z.). — In addition I have seen Pilsbry's holotype (Ac.N.S.Phila. No. 78483) and several specimens in various museums (M.C.Z.; U.S.N.M.; A.M.N.H.; Hamb.M.; Brus.M.; Berl.M.; Brit.M.). All seem to be from old collections and may have come originally from the same source. None bear a reliable locality. A few are labelled "Angola", almost certainly by error as no form of true *A. achatina* has ever been reliably collected there so far as I know. One shell at M.C.Z. is labelled "Sierra Leone", a more likely locality, in view of Germain's record from French Guinea, although the occurrence in both these countries needs to be confirmed.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
103.5 mm.	54.5	57	28.5	7 $\frac{3}{4}$	Abomey	
101	54	53	29	7 $\frac{3}{4}$	Brussels Mus.	
96	51	49	28	7 $\frac{1}{2}$	M.C.Z. No. 97934	
90	51	50	27	7 $\frac{1}{2}$	Brussels Mus.	
80	49.5	47	24	7	M.C.Z. No. 75564	

It may be noted that Pilsbry's type is appreciably larger than any of the specimens I have measured for the foregoing table, although it is considerably smaller than the unicolorous race which I call subsp. *depravata*.

f. *A. ACHATINA TOGOËNSIS* Bequaert and Clench

Pl. 2, fig. 2; Pl. 5, fig. 2; Pl. 7, fig. 2; Pl. 39, fig. 1

Achatina (?) *hamillei* v. Martens, 1893, Mitth. Deutsch. Schutzgeb., 6, pt. 3, p. 216 (Togo: Bismarckburg). Not of Petit, 1859.

Achatina togoënsis Bequaert and Clench, 1934, Rev. Zool. Bot. Afric., 26, pt. 1, p. 112 (Togo: Bismarckburg); Pl. 1, figs. 1 (paratype), 2 (holotype), 3 (paratype), and 4 (sculpture of holotype X 4).

"Shell broadly ovate, moderately thick and solid, uniformly and slightly shiny. Color pale olive-brown, with narrow, rather evenly spaced, oblique, chestnut-brown axial stripes, which are partly even, partly broken up into a fine zig-zag or occasionally into small spots (especially on the lower half of the whorls); on the body-whorl the stripes do not reach the columella; the first two and a half whorls are whitish, unstriped; on the next two whorls the stripes are faint, becoming gradually bolder; columella white, in the upper part slightly bluish; aperture pale bluish inside and showing the brownish stripes by transparence. Apex subobtuse, not drawn out. Whorls $7\frac{1}{4}$ (holotype), slightly convex, gradually increasing in size; sutures scarcely indented, slightly depressed on the body-whorl, very finely wrinkled. Spire broad, top-shaped, produced at an angle of 57° . Body-whorl about 78 per cent of the total shell. Aperture oval, slightly oblique, widest about the middle. Palatal lip (peristome) thin and simple, broadly rounded at the base. Parietal wall glazed bluish-white. Columella short, broad, almost straight, simple glazed throughout, very obliquely truncate, the broad truncation placed a short distance above the basal margin of the aperture. First two whorls microscopically granular in the youngest shell seen, partly worn smooth in older shells; remaining whorls decussately sculptured to the naked eye through the intersection of rather regularly spaced and moderately deep spiral lines with strong axial growth-wrinkles; on the third whorl this produces a fine beading, on the succeeding whorls regular, oblique rows of axial welts; the decussation is much fainter above the sutures and is lacking over the lower half of the body-whorl, which shows only faint growth-wrinkles." (Bequaert and Clench, 1934).

Specimens Examined. Togo: Bismarckburg, holotype (Berl.M. No. 47176, collected by Conradt), and 2 paratypes (R. Büttner, 1891.-

Berl.M. No. 43356 and M.C.Z. No. 98688). Also one immature paratype from Togo (E. Kling.—Berl.M. No. 42362).

The specimens collected by R. Büttner were the shells doubtfully referred to *A. hamillei* by v. Martens in 1893. *A. fulica hamillei* is strictly East African.

Although originally described as a distinct species, a study of the several variations in size and color of *A. achatina* has now convinced me that *togoënsis* is at most a subspecies. It is very similar to subsp. *elegans*, but lacks all trace of rose or violaceous color on the columella and parietal wall.

Measurements of Adult Shells

Length	Greatest		Aperture		
	Width	Length	Width	Whorls	
89.5 mm.	48.6	50	26	7¼	Holotype
89	49.2	51.3	27.6	7¼	Paratype
72.5	40.6	41.8	22.6	7	"

g. *A. ACHATINA BAYOLI* Morelet

Pl. 6, fig. 1; Pl. 9, fig. 1

Achatina bayoli Morelet, 1888, Jl. de Conchyl., **36**, p. 97 (Ivory Coast: Assinie); Pl. 1, fig. 4 (2 views of type).

Archachatina bayoli Pilsbry, 1905, Man. of Conch., (2), **17**, p. 118; Pl. 22, figs. 9–10 (after Morelet). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66.

Archachatina (Megachatinops) bayoli Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 86.

Morelet's original description (French text translated): "T. oblonge ovata, ventricosula, solidula, confertim striata et superne usque ad peripheriam (praeter nucleum) impressionibus aequidistantibus granulata, nitida, luteo-fulva, in ultimo anfractu strigis maculisque nigricantibus irregulariter picta, in superioribus confertim flammulata vel strigata. Columella vix arcuata, oblique truncata, pulchre purpurea. Anfr. 6½ convexi, ultimo medio obsoletissime angulato, spiram superante. Spira conoidea, obtusa, nucleo livido, laevigato. Apertura ovalis, intus pallide lilacina, opalina, flammulis maculisque translucetibus. Perist. acutum, tenue. — Longit. 66; diam. 30. Apert. 36 mill. longa, 20 lata. The shape is that of a somewhat elongate ovoid; the shell is therefore ventricose with a mediocre spire, the whorls of which are convex and the summit obtuse. The suture which joins them is simple, but strongly impressed. The columella, scarcely arched, is

obliquely truncate; it is striking for its bright purple color, which extends, but fades over the parietal wall of the aperture. The shell, of moderate thickness, rather thin in some specimens, is engraved with distinct, closely set striae, crossed at right angles by other less distinct and more spaced striae, forming a lengthened granulation, which usually is reduced to a simple striation on the second half of the last whorl. Sometimes, however, the ornamentation persists on the dorsal face to the end of the shell. The color is yellowish fulvous, on which stand out sharply dark brown striae and flammules, as well as spaced and very irregular small spots. This ornamentation, less distinct on the whorls preceding the last, but more closely set, more regularly spaced, is visible by transparence inside the aperture, which is tinged a very pale, slightly opaline lilac. On account of a certain analogy of size, proportions and colors, this shell may be compared to *Achatina papyracea*, *A. siderata* and *A. knorri*; but it could not be confused with the variety *minor* of *A. variegata*, for the similarity which seems to be noted between these shells vanishes as soon as one compares them. The second form, much more ventricose, has a more elongate and much less obtuse spire; as a result, its aperture is more dilated. Its coloration and especially its ornamentation are very different, and, although the sculpture of the surface is analogous in the two species, the effect is not the same, for *A. variegata* seems to the eye markedly rugose, whereas the other form, more finely chiseled, appears smooth. Finally in this one the suture is not margined." Several specimens were collected by Dr. Bayol and sent to Chaper, who deposited the type specimen at the Ecole des Mines in Paris. The others seem to have been distributed freely, for paratypes are found in various collections. I have seen some of these, but not the holotype. Morelet's figure is copied in my Pl. 9, fig. 1.

A. bayoli has thus far been placed in *Archachatina*, no doubt under the influence of Morelet's suggestion that his species showed some analogy to *papyracea*, *siderata* and *knorri*. However, the resemblance is very slight and indicates no true relationship. In particular, the nepionic whorls are not in the least dome-shaped and do not point to the abnormally large egg characteristic of *Archachatina*. The summit, although somewhat broader than in typical *A. achatina* (which may be correlated with the dwarfed size), is nevertheless obtusely pointed. Notwithstanding Morelet's statement to the contrary, the sculpture is essentially that of *A. achatina*. It is somewhat weaker than in the nominate subspecies, but it differs little in this respect from some of the other subspecies. The most distinctive features of *bayoli* appear to be the relatively narrower shape and more fusiform outline, as well as the peculiar arrangement of the color markings. The spire is

scarcely more narrowed than the base. This is the smallest race of *A. achatina*; but there is some doubt in my mind that even Morelet's largest specimen, apparently figured by him, was actually full-grown. The few specimens I have seen were all clearly immature. The largest of these was 56 mm. long, 30 mm. in greatest width, of 6 whorls, with the aperture 33.5 by 15.5 mm.

Specimens Examined. IVORY COAST: Assinie (one paratype, received from Ancy.—U.S.N.M.; 3 specimens collected by C. Alluaud, named by P. Dautzenberg.—Terv.M.; M.C.Z.; one paratype, sent by Chaper to Connolly.—Brit.M.; one specimen bought from Preston.—Leid.M.). According to Dr. E. Fischer (*in litt.*, 1949), the collection of the "Journal de Conchyliologie," now deposited at the Paris Museum, also contains an immature paratype, 48 mm. long.

ACHATINA (ACHATINA) BALTEATA Reeve

A. balteata is the only known representative in Upper Guinea of a complex of superficially similar species, with large, elongate-ovate to spindle-shaped shells, much more slender than *A. achatina*, fairly uniformly olivaceous-yellow, yellowish-brown or pale chestnut, sometimes with darker chestnut or mahogany streaks or blotches or with hydrophanous areas in the periostracum. The sculpture, characteristic of each species, consists of various types of wavy lines or granulations, particularly diagnostic on the body-whorl of full-grown shells. In 1934 (Amer. Mus. Novitates, No. 705, pp. 1-16) Bequaert and Clench published the first attempt to define the species on the basis of the sculpture. Further study of additional material and particularly of certain types in European Museums, has led me now to modify the nomenclature adopted in 1934 and has enabled me to include some other species or races in the same group. Their classification now stands as follows.

1. *A. balteata* Reeve, with the subsp. *infrasusca* v. Martens. Fully discussed in the present paper.

2. *A. iostoma* Pfeiffer, 1854 (Synonyms: *A. tiara* Preston, 1900; *A. hessei* C. R. Boettger, 1913; and *A. gruweli* Dautzenberg, 1921). See the 1934 paper. *A. hessei* is now believed to be not separable from *A. iostoma*.

3. *A. bandeirana* Morelet, 1866 (Synonym: *A. bandeirana capacior* C. R. Boettger, 1927). See the 1934 paper.

4. *A. dohrniana* Pfeiffer, 1870. Closely related to *A. balteata* and *A. iostoma*, but with the columella more twisted and very obliquely truncated at the base. The sculpture is stronger than in *balteata*, but

weaker than in *iostoma*, being well visible with the naked eye and just felt by touch. Moreover, while it is distinctly granulose on the early whorls, on the upper part of the body-whorl it consists of elongate, vertical welts, arranged fairly uniformly in spiral rows and vertical lines, becoming bead-like only below the periphery.

5. *A. stuhlmanni* v. Martens, 1892 (Synonyms: *A. rugosa* Putzeys, 1898; and *A. osborni* subsp. *hylaee* C. R. Boettger, 1927); with subsp. *chapini* Bequaert and Clench, 1934. See the 1934 paper. A study of the holotype and an immature paratype of *stuhlmanni* at the Berlin Museum, in 1933, and a comparison with two paratypes of *rugosa* (both from the type locality Micici), as well as with the holotype and paratype of *hylaee* at the Hamburg Museum, shows that neither of the two last-named differs, even subspecifically.

The sculpture of *A. balteata* is a fine to medium-sized granulation, covering practically the entire shell. On the youngest specimen seen, 47.5 mm. in length, of about 5 whorls, the nepionic shell, of about $2\frac{1}{2}$ whorls, is unicolorous pale straw-yellow, decussately and minutely granulose, except for the smooth first half-whorl (Pl. 71, fig. 1). On the first post-nepionic whorl appear vertical, straight or slightly wavy, spaced, light-brown streaks, distinct as far as the fourth whorl, then gradually fading, not being present except as traces beyond the fifth whorl in the nominate race of the species. In subsp. *infracusca*, these dark streaks are not only more marked and more mahogany-brown, but extend to the body-whorl of full-grown shells, at least as blotches or as half-streaks above the periphery. In full-grown shells, the granulation of the early whorls of the spire is well-marked and uniform, the beads being placed in distinct spiral rows, but less regular vertical lines. It is so delicate that it often imparts a silky appearance to the summit of the shell. On the penultimate whorl the granulation is much less regular, being interrupted by many smooth or wrinkled areas. On the body-whorl the granulation, though present, becomes more confused (Pl. 17, fig. 3), the growth-lines being coarser than the beads. On the upper half of the body-whorl, close to the outer lip, there are 25 to 30 beads over a vertical distance of about 1 cm. The granulation of the body-whorl is barely visible with the naked eye, but cannot be felt by touch. There is no trace of wavy sculpture, either vertical or spiral, the beads being too coarse. This species also lacks hydrophanous areas of the periostracum, even in the best preserved and freshest shells seen. In immature shells, up to 70 mm. long, the last whorl is more or less angular at the periphery, which usually shows a narrow spiral, light-brown streak, the latter sometimes present on the body-whorl of the adult.

A. balteata has an unusual discontinuous distribution, which is difficult to explain. The main range, where the species is fairly common in several localities, is Lower Guinea, from Cameroon to Central Angola (Novo Redondo and Golungo Alto), extending in the Congo Basin to the Upper Uele country. Originally it was described, however, from Gambia and there appears to be no valid reason to doubt that the types were actually taken there, as there are also two reliable records from Sierra Leone. Yet in the vast intervening area, from Liberia to Southern Nigeria, it has never been observed, so far as I am aware. Moreover, a most careful comparative study of specimens from Lower Guinea and the Sierra Leone-Gambia area, discloses no appreciable difference. It is here suggested that the colonies in the western section of Upper Guinea are isolated and the progeny of accidental or perhaps intentional introduction by man of living snails from the main Lower Guinea range.

a. Typical *A. BALTEATA*

Pl. 17, figs. 1 and 3; Pl. 18, fig. 2;

Pl. 41, fig. 1; Pl. 71, fig. 1; Pl. 77, fig. 4

Achatina fulva Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 251 (in part: measurements and reference to Pl. 11, figs. 3-4 of Syst. Conch.-Cab., **1**, Abt. 13, pt. 1, later recognized by Pfeiffer to represent *A. balteata*). Not *Bulinus fulvus* Bruguière, 1792; nor *Achatina fulva* Beck, 1837.

Achatina balteata Reeve, 1849 (February), Conch. Icon., **5**, *Achatina*, Pl. 2, fig. 7 (banks of the River Gambia). Jay, 1850, Cat. Shells Coll., 4th Ed., p. 216. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 164, and Explan. of Plates, p. 19; Atlas, Pl. 132, figs. 3-4 (2 views of one shell) and 5 (detail of sculpture) (Plate published after Férussac's death, presumably in 1851). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 487; 1857, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 304; Pl. 11, figs. 3-4 (specimen). Plate published without explanation or corresponding text in 1841). Gruner, 1857, Cat. Coll., p. 25. Morelet, 1858, Séries Conchyl., **1**, p. 20 (Gaboon). Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 603. v. Martens, 1860, in Albers, Die Heliceen, p. 201. A. D. Brown, 1861, Cat. Shells Coll., p. 55. Bielz, 1865, Verzeichn. Moll. Conch.-Samml., 3d Ed., p. 23. Morelet, 1867, Voy. Welwitsch, Moll. Terr. Fluv., (1868), p. 65 (Angola: Golungo Alto; District of Novo Redondo). Haines, 1868, Cat. Terr. Shells Coll., p. 67 ("Liberia"). Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 217. Paetel, 1869, Moll. Syst. Cat., p. 80; 1873, Cat. Conch.-Samml., p. 99. Fridrici, 1874, Bull. Soc. Hist. Nat. Metz., **13**, p. 184. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 275. v. Martens, 1876, Monatsber. Ak. Wiss. Berlin, p. 258; Pl. 2, fig. 2 (animal. Cameroon: Victoria). Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 53. G. R. Batalha,

- 1878, Cat. Coll. Conchyl. F. R. Batalha, p. 1. v. Martens, 1882, Jahrb. D. Mal. Ges., **9**, p. 245 (Portuguese Congo: Chinchoxo). Grasset, 1884, Index Test. Viv. Coll., p. 199. Vignon, 1888, Bull. Soc. Mal. France, **5**, p. 69 (Gaboon). Martorell y Peña, 1888, Catálogo Colección Conchol. Museo Martorell, Barcelona, p. 56. Bourguignat, 1889, Moll. Afr. Equat., p. 78. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 239. Stearns, 1893, Proc. U. S. Nat. Mus., **16**, p. 326 (Sierra Leone: Freetown). Boucard, 1901, Cat. Coll. Coq. Terr., p. 49. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 30 (Gaboon); Pl. 4, fig. 27 (after Reeve). Nobre, 1909, Bull. Soc. Portugaise Sc. Nat., **3**, Suppl. 2, p. 89 (Angola: Golungo Alto; Novo Redondo; Cazenge; Loanda; Quilombo; forests of Mupépé; forests of Zembe; region of Selles; Gumbá; Hambo; Supá; interior of Benguella).¹ Hidalgo, 1910, Mem. Soc. Españ. Hist. Nat., **1**, No. 29, p. 508 (Spanish Guinea: Cabo San Juan). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. Germain, 1911, Bull. Mus. Hist. Nat. Paris, **17**, p. 223 (French Congo: Marvisch River; Makoua; Ivindo River). C. R. Boettger, 1913, Ann. Soc. Zool. Mal. Belgique, **47**, (1912), p. 94 (Belgian Congo: Upoto, in 20° E.). Germain, 1913, Bull. Mus. Hist. Nat. Paris, **19**, p. 353, fig. 71 (young shell. French Equatorial Africa: M'Baiki in Lobaye District; Fort Rousset); 1916, Ann. Mus. Civ. Genova, **47**, p. 238 (French Congo: Fernand Vaz. Cameroon: Buea, 800 to 1200 m.). Pilsbry, 1919, Bull. Amer. Mus. Nat. Hist., **40**, p. 78. Dautzenberg, 1921, Rev. Zool. Afric., **9**, pts. 1-2, p. 87 (Cameroon: Yaunde, 700 m.). Connolly, 1928, Ann. Mag. Nat. Hist., (10), **1**, p. 540 (Sierra Leone: Freetown). Bequaert and Clench, 1934, Amer. Mus. Novitates, No. 705, p. 8, figs. 4-5 (Gambia: Bathurst. Cameroon: Kribi; Lolodorf. Belgian Congo: Ngayu). Coen, 1945, Catalogo Gasteropodi Polmonati Coll. Coen, p. 42. Not of Gould, 1850.
- Achatina (Archachatina) balteata* Albers, 1850, Die Heliceen, p. 190.
- Achatina (Achatinus) balteata* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265.
- Achatina monctaria* Morelet, 1867, Voy. Welwitsch, Moll. Terr. Fluv., (1868), p. 63 (Angola: region of Selles, in the interior of Novo Rodondo District); Pl. 8, fig. 2 (type). Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 272. Grasset, 1884, Index Test. Viv. Coll., p. 199. Bourguignat, 1889, Moll. Afr. Equat., p. 75. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 340. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 19; Pl. 5, fig. 6 (after Morelet). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. Germain, 1925, Mission Rohan-Chabot, **4**, pt. 3, p. 216 (says it is probably an abnormal *A. balteata*). Dartevelle, 1948, Bull. Service Géolog., Léopoldville, Congo Belge, No. 3, (1947), p. 110, footnote.
- Achatina (Achatinus) monctaria* Pfeiffer, 1879, Nomencl. Helic. Viv., p. 264.
- Achatina papyracea* Vignon, 1888, Bull. Soc. Mal. France, **5**, p. 71 (Gaboon). Not of Pfeiffer, 1845. According to Ancy, *Op. cil.*, p. 71, footnote, a specimen of *A. balteata*.

¹ Some of Nobre's localities no doubt were based on specimens of *Achatina bandeirana* Morelet, which he regarded as synonymous with *A. balteata*, an opinion with which I do not agree.

- Achatina iostoma* form *albina* O. Boettger, 1905, *Nachrichtsbl. D. Mal. Ges.*, **37**, p. 170 (Cameroon: Nongo Madiba on the Bali Road).
- Achatina balteata* var. *vidaleti* Germain, 1913, *Bull. Mus. Hist. Nat. Paris*, **19**, p. 354 (French Equatorial Africa: precise locality not given, but presumably from Fort Rousset, where Vidalet collected his other specimens of *A. balteata*).
- Achatina rugosa* Pilsbry, 1919, *Bull. Amer. Mus. Nat. Hist.*, **40**, p. 76 (in part: specimens from Ngayu, Belgian Congo, only). Not of Putzeys, 1898.

Original description of *A. balteata* Reeve (1849): "Achat. testa acuminato-oblonga, subfusiformi, crassiuscula, anfractibus octo ad novem, subplicato-striatis, undique creberrime minute granulatis, columella peculiariter arcuata, et contorta, abrupte truncata; flavescente, fasciis castaneis longitudinalibus apicem versus tineta, fascia spirali interrupta, subindistincta, medio cingulatis, columella et aperturæ fauce caerulescente-alba. Shell acuminate oblong, somewhat fusiform, rather thick, whorls eight to nine in number, slightly plicately striated, very closely minutely granulated, columella peculiarly arched and twisted, abruptly truncated; yellowish, stained towards the apex with chesnut longitudinal bands, and encircled round the middle with a rather indistinct interrupted spiral band, columella and interior of the aperture bluish-white. Very beautifully minutely granulated throughout, and characterized by a faint spiral band, in a manner which obtains some specific importance on account of its singularity." The original figure is copied in my Pl. 18, fig. 2. The two adult cotypes, from the Cuming Collection, which I saw at the British Museum in 1933, are much alike. They have the characteristic sculpture which I have described for *balteata*. The upper half of the body-whorl lacks all trace of dark brown vertical streaks. The figure of the type is 125 mm. long, 56 mm. in greatest width, with the aperture 59 by 30 mm., being relatively narrower than average.

Original description of *A. monetaria* Morelet (1867): "T. ovato-acuta, crassa, ponderosa, albido-livida, epidermide tenui, fulvescente, induta; spira contabulata, mucronata, apice acuta, carneola; anfr. 8, priores convexiusculi, minutissime granulati, 3 ultimi infra suturas horizontaliter planati, deinde convexiusculi; ultimus permagnus, deorsum ruditer et crebre granuloso-plicatus, spiram valde superans; columella crassa, alba, leviter arcuata, supra basim aperturæ oblique truncata; apertura ampla, subverticalis, sinuato-ovalis, intus lactea; perist. obtusum, rectum, extus fusco limbatum, margine externo superne breviter sinuoso, cum altero callo lato, crasso, albido, juncto. Longit. 142; diam. 65 mill." The following additional descriptive notes are translated from the French: "The specimen we have seen is unfortunately without periostracum, which judging from the remnants

must have been fulvous, variegated with some darker longitudinal streaks. The species is remarkable for its solidity and the spire arranged in tiers. The first whorls are regularly developed and form a rather sharp cone; the last three are swollen below the sutures, where there is a horizontal flattening which makes the shell somewhat scalariform. It cannot be decided from a single specimen whether this peculiarity is constant or merely accidental. The body-whorl is ventricose and ends in a broad, calloused aperture, with thickened margins and milky-white interior. The right margin [outer lip] is slightly dilated toward its insertion and margined with brown outside; the columella is arcuate, solid, ending in an oblique truncation and provided with a strong callosity over its entire length. The shell is engraved with distinct, closely set, granulose, more or less regular striae, more pronounced, as often happens, near the sutures." The type and only known specimen of *monetaria* is at the British Museum, where I saw it in 1933. It is a very old, bleached and worn shell, apparently picked up in or near a native settlement. Its peculiar shape is clearly abnormal. The sculpture, so far as preserved, is that of *balteata*, of which I regard it as a synonym, following Germain's (1925) suggestion. It is one of the largest specimens of the species on record. Morelet's figure is copied in my Pl. 41, fig. 1.

Germain (1913) gave the following brief description (translated from the French) of his var. *vidaleti*, based entirely on color: "The coloration [of *balteata*] also is variable. As a rule greenish-yellow in young shells, where the columella moreover is often tinged with violet, it turns more or less dark chestnut in the adult. However, some medium-sized specimens (95 mm. long, 50 mm. in greatest width, 42 mm. in lesser width) retain the pale yellowish-chestnut color with the violaceous columella. These specimens are the variety *ex colore* which I call var. *vidaleti*." On my visit to the Paris Museum in 1933 I was unable to examine the types of this variety. There is, however, nothing in the description to justify the retention of the name for a race of *balteata*. It was clearly based on immature specimens. In all young *balteata* the columella is partly violaceous, while in fully adult specimens this color tends to disappear; but even in some full-grown shells from Gambia the columella is blotched with purplish.

Ö. Boettger's *A. iostoma* form *albina* was based on specimens "almost unicolorous olive-yellow or olive-brown and with streaks on the upper whorls only; in addition often somewhat larger and more slender." A study of four of the types at the Senckenberg Mus. (Frankfort), in 1933, disclosed that they were *A. balteata*, not *A. iostoma*, so far as the sculpture is concerned. It is moreover impossible to separate them from the nominate race of *balteata*. An immature paratype is shown in my Pl. 77, fig. 4.

A. balteata has been used by certain African native tribes for monetary purposes. Morelet (1867, Voy. Welwitsch, Moll. Terr. Fluv., p. 47) relates that, in Angola, the shells are cut into disks, pierced in the center and put up in strings, to be used as money. According to C. R. Boettger (1913), at Upoto (Lisala), Belgian Congo, the shell is sawed lengthwise by the natives, the halves serving as currency.

Specimens Examined. Several merely labelled "West Africa" (U.S.N.M.). — GAMBIA: without precise locality (2 cotypes at B.M., others at M.C.Z., Amst.M., Berl.M.); Bathurst (Carn.M.; M.C.Z.). — SIERRA LEONE: Freetown (U.S.N.M.). — CAMEROON: Bafia (E. D. Horner.-M.C.Z.); Buca (P. Preuss.-Berl.M.; M.C.Z.); Kribi (G. Schwab.-M.C.Z.); Nongo Madiba on Bali Road (R. Rohde.-Types of *f. albina* at Frankf.M. and M.C.Z.); Lolodorf (A. J. Good.-Carn.M.; M.C.Z.). — FRENCH CONGO: Franceville (Terv.M.); Ombouet (C. R. Aschemeyer.-U.S.N.M.); Rembokotou (C. R. Aschemeyer.-U.S.-N.M.); Samkita, Ogowé River (M.C.Z.); Gaboon River (Berl.M.). — BELGIAN CONGO: Luvituku (Terv.M.); Kitobola (Terv.M.); Eala (J. Bredo.-Terv.M.); Leverville (Mrs. Tinant.-Terv.M.); Ngayu (Lang and Chapin.-A.M.N.H.; M.C.Z.).

The species is also reliably recorded from the Portuguese Congo, Angola, Spanish Guinea and the interior of French Equatorial Africa (Fort Rousset, 0° 30' S., 16° E.). Ngayu (1° 40' N., 27° 40' E.) is the easternmost locality known. Haines' (1868) indication "Liberia" I regard as wholly unreliable.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
148.5 mm.	73	81	38	9		Rembokotou
140.5	67	74.5	37	9		"West Africa"
138	68	74	40.5	9		Bathurst
137	62	67	33	9		Gaboon
133	65	69	38.5	9		Gambia
131	67.5	71	35	8½		Gaboon
124	62	65.5	36.5	7¾		Ngayu
120	60.5	61	30.5	8¾		"
114	57.5	64	34.5	7½		"
113	57	57	30	8½		Freetown
110	50	53.5	26	8½		Gaboon
105	51	52.5	28	8		"West Africa"

b. *A. BALTEATA INFRAFUSCA* v. Martens

Pl. 44, fig. 1; Pl. 51, figs. 1-2

Achatina dimidiata v. Martens, 1889, Conch. Mitth., **3**, pts. 1-2, p. 17 (French Congo: mouth of Gaboon River); Pl. 42, figs. 1-1a (front view of type and detail of sculpture). Not *Achatina dimidiata* E. A. Smith, 1878.

Achatina infrafusca v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Besch. Weichth., p. 89 (new name for *A. dimidiata* v. Martens, 1889).

Achatina balteata var. *infrafusca* Pilsbry, 1904, Man. of Conch., (2), **17**, p. 32 (French Congo: Gaboon, with specimens transitional to typical *balteata*); Pl. 4, figs. 22-23 (after v. Martens). Kobelt; 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. C. R. Boettger, 1913, Ann. Soc. Zool. Mal. Belgique, **47**, (1912), p. 94 (in part: only shell from French Congo: Quillo River, N. of Loango);¹ 1932, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 303 (French Congo: Lambarene). Bequaert and Clench, 1934, Amer. Mus. Novitates, No. 705, p. 11, fig. 6 (Belgian Congo: Lukolela. French Congo: Lambarene on Ogowe River).

Original description of *A. dimidiata* v. Martens (1889) (German text translated): "Testa fusiformi ovata, imperforata, rugosostriata, undique granulata, granulis spiratim seriatis, supra fulva, strigis castaneis plus minusve flexuosis vel abbreviatis picta, infra unicolor castanea; spira conica, sutura simpliciter; anfr. $8\frac{1}{2}$ vix convexiusculi, primi albi, sequentes magis confertim strigati; apertura dimidiam longitudinem non aequans, sinuato-ovalis, intus coerulescens, peristomate tenui recto castaneo, columella arcuata, coerulescenti-alba, basi attenuata, distincte truncata. Long. 120, diam. 60, apert. long. 59, diam. 32 mill. Shell between spindle-shaped and ovate, imperforate, wrinkled striate, covered everywhere with granulations placed in spiral rows; yellowish-brown above the suture and the periphery, with a few usually zigzag or briefly interrupted streaks; below the periphery (hence visible only on the body-whorl) uniformly chestnut-brown; at the limit between the two colors with occasional darker spots. Spire rather sharply conical; $8\frac{1}{2}$ almost flat whorls, the apical two unicolorous white, the next with numerous streaks. Aperture somewhat less than half the total length, ovate, but obliquely narrowed above and below, bluish inside; outer margin thin, straight, dark brown inside; columellar margin somewhat curved, bluish, narrowed below and then transversely truncate." I have seen the holotype at the Berlin Museum in 1933. It has the characteristic sculpture of *balteata*. The original figure is copied in my Pl. 44, fig. 1.

¹ The shells from Banana, Belgian Congo, referred by C. R. Boettger in 1913 to *infrafusca* were later described by him as *Achatina bandeirana capucior*, a form which I now regard as not separable from typical *A. bandeirana* Morelet.

As noted in the general description of the species, subsp. *infracusca* differs from the nominate race only in the color markings, the chestnut vertical streaks continuing to the upper half of the body-whorl. There are, however, transitional specimens between the two forms, which seem to occur together in some localities. Too little is known as yet of the distribution to decide whether the subspecies should really be kept separate or merely considered a synonym. It has been claimed that *infracusca* has a proportionately shorter and broader shell than typical *balteata*, but this is not borne out by the original measurements nor by the specimens I have seen.

Specimens Examined. CAMEROON: Etome (P. Dusén.-Stock.M.; M.C.Z.).—FRENCH CONGO: Gaboon River (holotype and another shell at Berl.M.; M.C.Z.; U.S.N.M.; A.N.S.Phila.); Lambarene, Ogové River (Mrs. L. Russell.-A.N.S.Phila.).—BELGIAN CONGO: Lukolela (J. P. Chapin.-A.M.N.H.); Inkongo near Lusambo (Terv. M.); Luluabourg (P. Callewaert.-Terv. M.).—Also an umbilicate abnormal shell from the Gaboon (Pl. 51, fig. 2) at M.C.Z.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
152 mm.	68.5	75	37	9		Lukolela
142	75	78.5	40	9		Gaboon
137.5	70	70	39	9		“
135	66	70.5	35	8 $\frac{2}{3}$		“
132	65	73	32.5	9		“
116	61	63	31.5	Apex broken		Lambarene

2. Subgenus PINTOA Bourguignat

Achatina subg. *Pintoa* Bourguignat, 1889, Moll. Afr. Equat., p. 80 (for *Achatina pfeifferi* Dunker, *A. semidecussata* Menke, *A. capelloi* Furtado, *A. zebriola* Morelet [= *zebriolata*], *A. polychroa* Morelet, and *A. colubrina* Morelet). Type by designation of Pilsbry, 1904, Man. of Conch., (2), 17, p. 24: *Achatina pfeifferi* Dunker, 1845.

It is not clear whether Bourguignat intended to give *Pintoa* generic or subgeneric status. He defined the group as follows: "Spire elongate obtuse. Spiral growth slow. Aperture oval or semicircular, rather small, never reaching half the height of the shell. Columella short" (translated from the French). The name is here restricted to what appears to be a fairly natural group of small species, 55 mm. or less

in length, usually slender in outline and with relatively short aperture, shaped more like *Limicolaria*, but with distinctly truncate columella. In addition, the sculpture is as in *Achatina*, proper, with the newly hatched nepionic shell finely and regularly granulose (except for the smoothish first half-whorl) and the post-nepionic whorls at least partially decussate. As a rule the early post-nepionic whorls are markedly granulose, while the later ones bear vertical lengthened welts separated by distant spiral grooves. Sometimes the sculpture becomes less pronounced on the body-whorl of full-grown shells, particularly below the periphery. *A. semisculpta*, here included in *Pintoa*, is in shape clearly transitional to *Achatina*, proper.

The following five species are decidedly granulose on the nepionic whorls at least of the best preserved specimens I have examined. It is possible that in some of the species which I place in the sequel in the subgenus *Leptocalina*, the nepionic shell may be granulose when newly hatched; in which case they will have to be transferred to *Pintoa*.

1. *A. parthenia* Melvill and Ponsonby, 1903.
2. *A. puectes* Melvill and Ponsonby, 1893.
3. *A. pfeifferi* Dunker, 1845 (Synonym: *A. ivensi* Furtado, 1886); with subsp. *cugrapta* Pilsbry, 1919.
4. *A. polychroa* Morelet, 1866.
5. *A. semisculpta* Pfeiffer, 1845.

Of the other species originally included by Bourguignat in *Pintoa*, *A. semidecussata* Menke has a broad, dome-shaped summit, for which reason I have transferred it to my new subgenus *Tholachatina*, in *Archachatina*. *A. capelloi* Furtado has the nepionic whorls unquestionably smooth, while most of the remainder of the shell is coarsely decussate, so that I relegate it to the subgenus *Lissachatina*. *A. zebraolata* Morelet and *A. colubrina* Morelet, also with smooth nepionic whorls, seem to belong to the subgenus *Leptocalina*.

3. Subgenus TRIPACHATINA Bourguignat

Tripachatina Bourguignat, 1889, Moll. Afr. Equat., p. 73. Monotypic for *Achatina vignoniana* Morelet, 1874.

According to Bourguignat, the subgenotype is "remarkable for the oblique and weak columellar truncation and the open umbilical perforation, which is limited by a strong angle forming an obtuse crest." It should be added that the general shape of the shell is that of a young *A. achatina* and that the nepionic whorls are densely granulose almost from the very start. The few known specimens of the only species included, *A. vignoniana*, seem to have all been part of the original lot,

collected at some unknown locality in the interior of the Gaboon. These specimens, the largest of which measures 105 mm. in length, appear to be all immature and it is a question whether the umbilicus might not be completely closed in the fully adult shell. One of the smaller specimens is shown in my Pl. 69, fig. 1. The original figure of the type is copied in my Pl. 17, fig. 2. The species was described from the Vignon Collection. The present whereabouts of the figured type is unknown; it is not at the Paris Museum (Dr. E. Fischer, *in litt.*, 1949).

4. LISSACHATINA, new subgenus

Nepionic whorls of newly hatched snails without granulation or decussated sculpture, either completely smooth or with faint vertical wrinkles; in older shells these early whorls are sometimes corroded and irregularly pitted or rugose. Post-nepionic whorls granulose or decussate; the sculpture sometimes very weak or evanescent on the body-whorl of adult shells. Apex of full-grown shell either of the usual conical shape or more or less drawn out into a narrow nipple, in which case the nepionic whorls may eventually break off. Most species are large or medium-sized, broadly ovate, elongate ovate or spindle-shaped; a few are slender and shaped like *Pintoa* or *Limicolaria*, differing from the former in the smooth nepionic whorls and from the latter in the truncate columella.

Subgenotype: *Achatina fulica* Bowdich, 1822.

Since in some species of *Achatina*, proper, and of *Pintoa*, the decussate sculpture of the nepionic whorls often wears off with age, a careful study of very young shells is essential to place the species correctly. I have seen young shells of most of the forms listed below. Some others, included because they appear to be closely related to species unquestionably with a smooth nepionic shell, should be studied again in the very early stages.

The synonyms of the species more fully treated in the present paper, will be discussed at some length. The synonymy of the others, as indicated in the following list, is only tentative.

1. *A. albicans* Pfeiffer, 1853.
2. *A. albopicta* E. A. Smith, 1878. See below.
3. *A. allisa* Reeve, 1849. See below.
4. *A. bayoniana* Morelet, 1867 (author's correction of *bayaona* Morelet, 1866).
5. *A. bloeyti* Bourguignat, 1889 (Synonyms: *A. fatalis* v. Martens, 1895; *A. retzii* d'Ailly, 1910).
6. *A. capelloi* Furtado, 1886 (Synonyms: *A. morrelli* Preston, 1905;

and *A. rhodesiaca* var. *lanccolata* Melvill and Standen, 1907); with subsp. *rhodesiaca* Melvill and Standen, 1907 (Synonyms: *A. rhodesiaca* var. *leucopasa* Melvill and Standen, 1907; *A. morrelli* var. *kafuensis* Melvill and Standen, 1907; and *A. schoutedeni* Dautzenberg and Germain, 1914).

7. *A. connollyi* Preston, 1912.

8. *A. craveni* E. A. Smith, 1881 (Synonyms: *A. kirkii* E. A. Smith, December, 1880, not of Craven, March, 1880; *A. jacobii* Da Costa, 1906; *A. ovata* Da Costa, 1907; *A. zebrina* Da Costa, 1907); with subsp. *aretspirata* Bourguignat, 1889 (Synonym: *A. fulminatrix* v. Martens, 1895); subsp. *randabelli* Bourguignat, 1889; and subsp. *virgulata* Da Costa, 1907.

9. *A. delorioli* Bonnet, 1864. See below.

10. *A. fulica* Bowdich, 1822. See below.

11. *A. glaucina* E. A. Smith, 1899.

12. *A. glutinosa* Pfeiffer, 1853 (Synonym: *A. ptersi* v. Martens, 1860).

13. *A. immaculata* Lamarck, 1822 (Synonym: *A. mariei* Ancey, 1894).

14. *A. iredalei* Preston, 1910. See below.

15. *A. johnstoni* E. A. Smith, 1899.

16. *A. kilimae* Dautzenberg, 1908. Position uncertain.

17. *A. lactea* Reeve, 1842. See below.

18. *A. layardi* Pfeiffer, 1858.

19. *A. panthera* Férussac, 1832. See below.

20. *A. reticulata* Pfeiffer, 1845. See below.

21. *A. spekei* Dohrn, 1864 (Synonym: *A. thomsoni* E. A. Smith, 1880). Pl. 62, fig. 3; Pl. 81, figs. 2 and 3.

22. *A. vassei* Germain, 1918.

23. *A. yalaensis* Germain, 1936.

24. *A. zanzibarica* Bourguignat, 1879. See below.

East African Species of *Lissachatina*

ACHATINA (LISSACHATINA) FULICA Bowdich

When full-grown, the shell of *A. fulica* consists of from 7 to 9 (very exceptionally 10) whorls, with a moderately swollen body-whorl and a sharply conical spire, which is distinctly narrowed but scarcely drawn out at the apex. The outline varies greatly, even in the same colony, from very slender to moderately obese, the broader specimens tending to be shorter for the same number of whorls. All whorls are

decidedly convex, due to the broadly impressed sutures. The aperture is relatively short, even in the broadest specimens, being always shorter than the spire, often considerably so. The outer lip is usually sharp and thin, rarely somewhat thickened or even slightly expanded in very old specimens; it is very convex, evenly curved into a regular semi-ellipse, and inserted on the body-whorl at a sharp, open angle, the upper part of the body-whorl being scarcely or not flattened behind the lip. The columella is more or less concave, sometimes rather weakly so, in which case it may be slightly or even much twisted; it tends to be more concave in the broader shells. It should be noted that in *A. fulica* all stages, from the nepionic shell on, have the umbilical slit completely closed and the columella truncate. In all specimens seen, which on general shape and sculpture were referable to *A. fulica*, both columella and parietal callus are white or bluish-white, without any trace of pink. The importance which I attach to this feature will be more fully discussed under *A. fulica hamillei* and *A. panthera*.

The newly hatched, nepionic shell is 5 to 5.5 mm. long and about 4.5 mm. wide, of $2\frac{1}{2}$ nearly smooth whorls, without any granulation or decussation and with only the weakest traces of vertical wrinkles (Pl. 19, figs. 3 and 4). The first half post-nepionic whorl is more distinctly wrinkled vertically, but not yet decussate; after this the vertical growth-striae become gradually stronger and are now cut by spiral engraved lines into elongate, vertical welts; at first weak, the decussation gains in strength on the fourth and fifth whorls, where it is visible to the naked eye, after which it decreases again, being superficial on the sixth and usually lacking on the seventh and succeeding whorls. In young shells, the periostracum of the early post-nepionic whorls shows in addition to the decussation a superficial, microscopic criss-cross texture, as if a finely woven cloth had been pressed onto the surface; but no trace of this remains on older shells. In the largest full-grown adult shells, of 7 to 9 whorls, the body-whorl is nearly even, the growth-striae being very low or superficial, except below the suture where they form short, strong folds, very lightly crenulating the irregular sutural line. When the periostracum is fresh and intact, the terminal whorls appear not only smooth, but also glossy. The ground color and markings vary greatly and will be discussed under the several races. When present in the adult, the darker markings appear almost at once on the first post-nepionic whorl as faint, vertical, straight, pale-brown streaks; in very young shells these streaks stop at the periphery, forming there slightly deflected spots.

The egg is broadly ellipsoidal, 5 to 5.5 mm. by 4 to 4.5 mm., slightly

larger in subsp. *hamillei* than in the nominate race, white or slightly yellowish, with a very thin and brittle calcareous shell. In controlled breeding carried on by Mr. D. B. Langford in Guam, shells 1 week old, of about 3 whorls, were nearly 6 mm. long (Pl. 19, fig. 3); they reached 9 mm., with $3\frac{1}{2}$ whorls, at 2 weeks; 14 mm., with 4 whorls, at 3 weeks; 16.5 mm., with $4\frac{1}{3}$ whorls, at 4 weeks; 22 mm., with $4\frac{1}{2}$ whorls, at 5 weeks; 27.5 mm., with nearly 5 whorls, at 6 weeks; 31 mm., with $5\frac{1}{3}$ whorls, at 7 weeks; 35.5 mm., with $5\frac{1}{2}$ whorls, at 8 weeks; 46 mm., with 6 whorls, at $2\frac{1}{2}$ months; 75 mm., with $6\frac{1}{3}$ whorls, at 3 months; and 92 mm., with slightly over $6\frac{1}{2}$ whorls, at 5 months. Although these 5 month old snails were as yet far from full-grown, they mated and started laying eggs. The species may be sexually mature even before being 5 months old. The largest shell I have seen from Guam is 131 mm. long, for $8\frac{1}{3}$ whorls. Later growth, after sexual maturity is reached, appears to be very slow and the snail may live for several years. Doeters van Leeuwen (1932) relates that a specimen, brought alive from Singapore, was kept in captivity in Java for 9 years, reaching 4 inches in length when it died. Mr. G. S. Dun, Entomologist to the Department of Agriculture, Territory of Papua-New Guinea, has recently given me some valuable information on *Achatina fulica* in his area (*in litt.*, 1949). After noting that near Rabaul, New Britain, the snail sometimes reaches as much as 175 mm. in length, he writes: "It is of interest to note that these very large specimens are fast becoming increasingly rare. When I first went to New Britain, over two years ago, these large individuals were quite common in a number of localities. At one particular locality adjacent to Keravat, the vanguard of the snails' approach was largely comprised of the very large specimens. At this spot they had arrived from a nearby Japanese camp where they were cultured. Eighteen months ago it was possible to collect the very large snails in dozens daily. Now, however, when specimens are required, it may take several days to collect a single large snail. As these individuals are evidently of a considerable age, it occurred to me that the Japanese may have had a forcing diet for them which they are now unable to obtain naturally and subsequent generations are consequently smaller. Caged specimens that I have reared from the egg stage and are now over two years old, have failed to exceed $3\frac{1}{2}$ ins., while many of them are less than 3 ins."

Pilsbry (1904, p. 57) first suggested that the original home of *A. fulica* was the coastal area of continental East Africa, an opinion to which I fully subscribe. This coastal area is nowadays inhabited by the subsp. *hamillei*, which I regard as the ancestral stock of the species. Here it occurs from southern Abyssinia and the southern half of Italian Somaliland, through Kenya Colony and Tanganyika Territory, as far

as northern Portuguese East Africa. The northernmost reliable record appears to be in $7^{\circ} 30' N.$, the southernmost in about $17^{\circ} S.$ Inland it extends 150 to 500 miles from the coast. The small islands off the East African coast, including Zanzibar and Pemba, where it now lives, I consider as part of the original range, their flora and fauna being mainly continental. It was most probably transported by man from the East Coast to Madagascar. Its later dispersal by man to Mauritius, Asia and the Pacific is a matter of historic record, more fully presented under the nominate race of the species.

The habits of *A. fulica* are essentially those of the other species of *Achatina*. It is, however, not as strictly terrestrial as *A. achatina*. In a paper published as a separate issue of this Bulletin, Dr. F. X. Williams presents his observations on the behavior, food preferences, mating, parasites, and predators of *A. fulica hamillei* in East Africa.

The first, very brief observations on the animal of a species of *Achatina* were by de Blainville on a preserved specimen of *A. fulica* collected by Quoy and Gaimard in Mauritius about 1820-1822. He wrote (1824, Dict. Sci. Nat., **32**, p. 250, referring to the snail as "Agathine zèbre"): "We have observed in the animal a sort of interruption of the collar, at the junction of right and left sides, as well as a projection of the columellar muscle producing the truncation of the columella of the shell." Lesson (1831) gave a fairly complete description of the animal (as *A. couroupa*), together with a good figure drawn from life in Mauritius: "The animal of this *Achatina* is very robust, large, very fleshy, with a foot ending in a point, convex above, everywhere much areolate and very dark, sombre violaceous. The eyes are globular, yellow, borne on two long cylindrical peduncles, dilated at their insertions. The two labial tentacles are swollen at the tip, half again shorter than the foregoing and also more voluminous at their insertions. The mouth is covered over by an upper festoon, deeply divided in the middle, thus forming two very prominent covering lobes." The anatomy of this species, now treated at length by Dr. A. R. Mead, was first described by Quoy and Gaimard (1831), together with a good account of the external features of the animal, but with rather crude figures.

Synopsis of Subspecies. Disregarding mere abnormalities, some 20 names have been proposed for various variants of *A. fulica*, this species being extremely variable in size and shape, and to some extent also in texture and color. After studying extensive series of nearly 1000 adult shells and many immatures, from a variety of places, I am able to recognize by name five forms only. Some of these are rather poorly defined and might perhaps better be sunk as synonyms; they are retained here as a concession to prevailing practice and in order to

prevent that they be described again under some new name. All forms are given subspecific status for purely nomenclatorial reasons, although several are not geographically segregated and they are not all of equal value.

A. Boldly marked with vertical streaks of dark-chestnut or blackish-brown on a pale dirty-white or yellowish background, often also with small scattered spots; the dark streaks sometimes confluent, particularly on the body-whorl, which may be nearly all dark-chestnut.

1. Medium-sized to large shells, 100 to 200 mm. in length when full-grown, usually rather heavy. Elongate-oval, slender or moderately swollen on the average, the whorls decidedly convex, broadly concave at the deep sutures. Body-whorl and aperture relatively short. Typical *A. fulica*.

2. Averaging usually larger than the nominate race. Broadly to very broadly oval, the whorls moderately convex and more shallowly concave at the sutures. Body-whorl and aperture relatively longer. Subsp. *hamillei*.

3. Small shells, when full-grown less than 60 mm. in length, shaped much like the nominate race. Subsp. *coloba*.

B. 4. Shell white, the periostracum uniformly or nearly uniformly olivaceous-yellow to pale golden-yellow, occasionally with a few darker, straw-yellow streaks. Size and shape of subsp. *hamillei*. Subsp. *rodatzki*.

C. 5. Whorls more or less distinctly divided into two areas: one uniformly dark buff above the periphery, the other much paler, light brown, below the periphery. Rarely faint traces of darker streaks or blotches in the upper buff area. Apparently known only from immature shells. Subsp. *castanea*.

a. Typical *A. FULICA*

Pl. 7, fig. 1; Pl. 16, fig. 3; Pl. 19, fig. 3; Pl. 20, fig. 2;
Pl. 21, fig. 2; Pl. 22, fig. 1; Pl. 23, fig. 4; Pl. 24, fig. 2;
Pl. 25, fig. 1; Pl. 26, fig. 2; Pl. 27, fig. 2; Pl. 28, fig. 2;
Pl. 29, figs. 1-2; Pl. 30, fig. 2; Pl. 31, figs. 1-2;
Pl. 32, figs. 1-2; Pl. 33, fig. 2; Pl. 34, fig. 2; Pl. 35,
fig. 1; Pl. 36, figs. 1-2; Pl. 37, fig. 4; Pl. 38, fig. 3

[Lister, 1688, Method. Conchyl. Liber Quartus, Pl. 582, fig. 35a; and Pl. 578, fig. 33].

[Seba, 1758, Rer. Nat. Thesauri, 3, p. 169; Pl. 71, figs. 4-5].

?*Bulla achatina* γ Born, 1780, Test. Mus. Caes. Vindobonensis, p. 209 (no locality); Pl. 10, fig. 2 (unrecognizable; apparently a dead, weathered shell).

Bulimus zebra Bruguière, 1792, Encycl. Méthod., Vers, 1, pt. 2, p. 357 (in

part: reference only to Seba, Pl. 71, figs. 4-5; also specimens collected by Bruguière at Foulépointe, Madagascar).¹

Ampulla kambeul "Bolten" Röding, 1798, Museum Boltenianum, pt. 2, p. 110 (in part: reference to Lister, Pl. 578, fig. 33, only); 1819, *Op. cit.*, 2d Ed., (by J. Noodt), p. 78 (in part, as before).² Not *Bulimus kambeul* Bruguière, 1789.

[*Helix* (*Cochlitoma*) *fulica* Férussac, 1821 (? May), Tabl. Syst. Moll., Tabl. Limaçons, p. 49 (or p. 53) ("Ile de France" = Mauritius; no description; with a doubtful reference to Lister's Pl. 578, fig. 33)]. *Nomen nudum*, not being validly defined.

[*Helix* (*Cochlitoma*) *borbonica* Férussac, 1821 (? May), Tabl. Syst. Moll., Tabl. Limaçons, p. 49 (or p. 53) ("Ile de Bourbon" = Réunion; no description nor reference)]. *Nomen nudum*.

Achatina fulica "Lamarck" Bowdich, 1822 (February), Elements of Conchology, 1, Pl. 13, fig. 3 (with name in accompanying Explanation of Plate; no locality or description). Deshayes, 1838, in Lamarck, Hist. Nat. Anim. Sans Vert., 2d Ed., 8, p. 297, footnote (says it is the correct name for *A. mauritiana* Lamarck); 1844, *Op. cit.*, 3d Ed., 3, p. 375, footnote. Porro, 1846, Coll. Mus. Modiol., Moll. Terr. Fluv., p. 17. Pfeiffer, 1848, Monogr. Helic. Viv., 2, p. 254. Reeve, 1849, Conch. Icon., 5, *Achatina*, Pl. 2, fig. 8; Pl. 3, fig. 8b; Pl. 11, fig. 8c (umbilicate abnormality) (Mauritius). Philippi, 1849, Abb. Beschreib. Conch., 3, pt. 5, p. 30 (p. 8 of *Achatina*); Pl. 2 (of *Achatina*), fig. 3 (Madagascar). Petit, 1850, Jl. de Conchyl., 1, p. 76 (Madagascar). Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., 2, pt. 2, p. 162, and Expl. of Plates of Atlas, p. 18. Mörch, 1852, Cat. Conch. Yoldi, 1, p. 20. Pfeiffer, 1853, Monogr. Helic. Viv., 3, p. 488. Woodward, 1854, Manual of the Mollusca, pt. 2, p. 160, fig. 90 (radula). J. E. Gray, 1855, Cat. Pulmonata Brit. Mus., 1, p. 3, fig. 2 (radula). Benson, 1858, Jl. de Conchyl., 7, pp. 266-268 (introduced from Mauritius to Calcutta in April, 1847). Pfeiffer, 1859, Monogr. Helic. Viv., 4, p. 603. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 201. Morclet, 1860, Séries Conchyl., 2, p. 70 (Madagascar. Réunion. Mauritius. Comoros). A. D. Brown, 1861, Cat. Shells Coll., p. 55. Deshayes, 1863, in Maillard, Notes Ile Réunion, 2d Ed., 2, Annex E, p. 90 (Réunion). Mörch, 1863, Cat. Conch. Lassen, p. 4. Kefenstein, 1864, in Bronn's Classen u. Ordnungen d. Thier-Reichs, 3, pt. 2, Pl. 95, fig. 23 (radula after Woodward). Mörch, 1865, Jl. de Conchyl., 13, p. 386 (jaw; radula). Bielz, 1865, Verzeichn. Moll. Conch.-Samml., 3d Ed., p. 23. v. Martens, 1866, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 16 (umbilicate abnormality from Seychelles). Haines, 1868, Cat. Terr. Shells Coll., p. 67.

¹ *Bulimus zebra* Bruguière was a composite species originally. The trivial name was restricted to the South African *Achatina zebra* by Férussac (1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 50 (or 54), and 1832, Hist. Nat. Moll. Terr. Fluv., Atlas, Pl. 133, in Livr. 28, with name printed on the Plate), Reeve (1842; 1849), Krauss (1848), and Pilsbry (1904).

² In order to forestall any future attempt to use the trivial name *kambeul* for *Achatina fulica*, I herewith restrict *Ampulla kambeul* Röding, which was a composite species, to the shell represented by Röding's first reference to "Martini 1024, 1025" (i.e. Chernitz, 9, Pl. 119, figs. 1024-1025). These figures are in my opinion *Limicolaria kambeul* (Bruguière, 1789).

Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 217. v. Martens, 1869, in v. d. Decken's Reisen Ost-Afrika, **3**, pt. 1, p. 58 (Seychelles); Pl. 2 (Mollusca), figs. 1a (normal shell) and 1b-c (umbilicate abnormality). Pactel, 1869, Moll. Syst. Cat., p. 80. G. Nevill, 1869, Proc. Zool. Soc. London, p. 64 (Seychelles: Mahé; Praslin; Silhouette; a smaller, thinner form than in Mauritius); 1870, Jl. Asiatic Soc. Bengal, **39**, pt. 4, p. 414 (Réunion). Pactel, 1873, Cat. Conch.-Samml., p. 99. Fridrici, 1874, Bull. Soc. Hist. Nat. Metz, **13**, p. 184. v. Martens, 1876, Jahrb. D. Mal. Ges., **3**, p. 250 (Comoros: Anjouan). Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 275. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 53. Liénard, 1877, Cat. Faune Mal. Maurice, pp. 54 and 90 (Mauritius. Seychelles: Mahé; Praslin). Morelet, 1877, Jl. de Conchyl., **25**, p. 335 (Comoros: Anjouan). G. R. Batalha, 1878, Cat. Coll. Conchyl. F. R. Batalha, p. 2. Clessin, 1878, Jahrb. D. Mal. Ges., **5**, pp. 179, 181, 183, and 184. Morelet, 1879, Jl. de Conchyl., **27**, p. 315. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 145. Kobelt, 1880, Illustrirte Conchylienbuch, **2**, p. 263; Pl. 81, fig. 1 (figure possibly of another species). v. Martens, 1880, in Möbius, Beiträge Meeresfauna Mauritius Seychellen, p. 197. Crosse, 1881, Jl. de Conchyl., **29**, p. 196 (Madagascar: Nossi-Comba). Morelet, 1883, *Op. cit.*, **31**, p. 210 (Comoros: Mayotte). Grasset, 1884, Index Test. Viv. Coll., p. 199. Martorell y Peña, 1888, Catálogo Colección Conchol. Museo Martorell, Barcelona, p. 56. Bourguignat, 1889, Moll. Afr. Equat., p. 76. Pactel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 239. Crosse and Fischer, 1889, in Grandidier, Hist. Phys. Nat. Pol. Madagascar, **25**, Moll., Atlas, pt. 1, Pl. 20, fig. 1; Pl. 21, fig. 1. Brancsik, 1893, Jahresh. Naturw. Ver. Trensčener Comit., **15-16**, (1892-1893), p. 204; Pl. 6, fig. 6 (anatomy figured, but not described, of scalariform specimen from Madagascar: Sualala on Bali Bay). Dautzenberg, 1893, Bull. Soc. Zool. France, **18**, p. 79 (Seychelles: Praslin). Cooke, 1895, Cambridge Natural History, **3**, p. 211, fig. 107D (jaw), and p. 279. v. Martens, 1898, Mitt. Zool. Mus. Berlin, **1**, pt. 1, p. 30 (Seychelles). Boucard, 1901, Cat. Coll. Coq. Terr., p. 49. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 55; Pl. 36, figs. 18 (specimen), 19 (specimen from Mauritius), and 20 (specimen from Madagascar); Pl. 37, figs. 22 (umbilicate, after v. Martens, 1869), 23 (specimen from Calcutta), and 24 (after Reeve). Sykes, 1905, Proc. Mal. Soc. London, **6**, pt. 5, p. 266 (umbilicate specimens from Mauritius and Seychelles). Ancy, 1906, Bull. Scient. France Belgique, **40**, p. 190 (sinistral). Anandale, 1907, Rec. Indian Mus., **1**, pp. 176-177 (common near Calcutta). E. A. Smith, 1908, Proc. Mal. Soc. London, **8**, pt. 1, p. 1 (sinistral). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, pp. 65, 90, 93, and 95. Rolle, 1910, *Op. cit.*, **32**, p. 193; Pl. 17, figs. 3 and 4 (abnormal shells). Pearson, 1910, Spolia Zeylanica, **7**, p. 110 (Ceylon: Moragalla; shell $6\frac{1}{2}$ inches long). Green, 1910, *Op. cit.*, **7**, p. 56 (Ceylon: very common in the Beruwala region); 1910, Circ. Agric. Jl. R. Bot. Gard. Ceylon, **5**, No. 7, pp. 55-64; Pl.; 1911, The Zoologist, (4), **15**, pp. 41-45 (egg. Introduced in Ceylon probably some 10 years before); Pl. 2. Connolly, 1912, Ann. South Afr. Mus., **13**, pt. 5, p. 188 (only specimen ever taken in South

Africa was found in a garden at Durban, Natal, about 1911). Dautzenberg, 1914, Bull. Soc. Zool. France, **39**, p. 57 (sinistral). Standen, 1917, Jl. of Conch., **15**, pt. 5, p. 160 (egg). Paiva, 1919, Rec. Indian Mus., **16**, pp. 19-28 (attacked by the lampyrid, *Lamprophorus tenebrosus*, in India). Odhner, 1919, Arkiv f. Zool., **12**, No. 6, p. 44 (Madagascar: Fénérive. Comoros: Mayotte). Annandale, 1919, Nature, (London), **104**, pp. 412-413. Hutson, 1920, Tropical Agriculturist, **55**, pp. 217-225, figs. 1-3 (on p. 220) (spread in Ceylon; attacked by *Lamprophorus tenebrosus*). Germain, 1921, Mém. Soc. Zool. France, Vol. Suppl., pp. 183 and 464 (egg); Pl. 10, figs. 1-2 (scalariform abnormality); Pl. 11, fig. 1 (umbilicate type of *A. rediviva* Mabille); Pl. 12, figs. 1-2 (2 paratypes of *A. rediviva*). Paravicini, 1922, Teysmannia, **33**, p. 24; Pl. 1, fig. 1 (not yet in Dutch East Indies). South, 1922, Malayan Agric. Jl., **10**, p. 267; 1923, *Op. cit.*, **11**, p. 253 (first occurrence in Federated Malay States). Jarrett, 1923, Singapore Naturalist, **1**, pt. 2, pp. 73-76 (occurrence in Malay Peninsula). Hutson and Austin, 1924, Dept. Agric. Ceylon, Bull. **69**, pp. 1-16; Pl. (*Lamprophorus tenebrosus* attacking this snail in Ceylon). v. d. Meer Mohr, 1924, De Tropische Natuur, **13**, pp. 26-27, fig. 1 (not yet in Dutch East Indies). South, 1924, Malayan Agric. Jl., **12**, pp. 36 and 229; 1925, *Op. cit.*, **13**, p. 201. (Anonymous), 1925, Jaarboek Dept. Landbouw Nijverheid Handel, Batavia, p. 61 (snails found in soil brought with plants to Java from Ceylon). South, 1926, Malayan Agric. Jl., **14**, pp. 157 and 231-241 (spread in Malay Peninsula). Spence, 1926, Jl. of Conch., **18**, pt. 2, p. 53 (sinistral from Mauritius). Paravicini, 1926, Arch. f. Molluskenk., **58**, pt. 4, p. 185. Pereira, 1926, Year-Book Dept. Agric. Ceylon, p. 62 (spread in Ceylon). (Anonymous), 1927, Malayan Agric. Jl., **15**, p. 149. v. d. Meer Mohr, 1927, De Tropische Natuur, **16**, pp. 206-208, fig. 1 (not yet in Dutch East Indies). Bertrand, 1928, Tropical Agriculturist, **71**, pt. 3, pp. 151-152 (damage to soil cover crops in Ceylon; control). Smedley, 1928, Malayan Naturalist, **2**, pt. 1, p. 47 (spread in Malay Peninsula). Birkinshaw, 1928, Malayan Agric. Jl., **16**, p. 154 (spread to Perak, Johore, and Kelantan in Malay Peninsula). Corbett, 1929, *Op. cit.*, **17**, p. 275 (spread to Johore and Kelantan). Doscas, 1929, *Op. cit.*, **17**, p. 287. Lamy, 1929, Jl. de Conchyl., **73**, p. 201 (egg). Haas, 1929, Zool. Jahrb., Abt. Syst., **57**, pp. 396 and 411 (Comoros: Convalescence, 1900 m., Great Comoro; Moheli; Ambarahani Mt., Moheli; Chumaduni Id.; Cerce de Bambao, Anjouan. Madagascar: Sahana in the East). Dammerman, 1929, Agricultural Zoology Malay Archipelago, p. 119, fig. 51. Connolly, 1931, Jl. of Conch., **19**, pt. 4, p. 103. Jarrett, 1931, Hong Kong Naturalist, **2**, pt. 4, pp. 262-264 (occurrence near Amoy, China, in 1931; in Sarawak, Borneo since 1928); Pl. 3 (2 views of one shell); 1932, *Op. cit.*, **3**, pt. 1, p. 70. Doeters van Leeuwen, 1932, *Op. cit.*, **3**, pt. 1, p. 71 (snail kept alive for 9 years). Grandidier and Petit, 1932, Zoologie de Madagascar, p. 192. Corbett, 1933, Malayan Agric. Jl., **21**, pp. 77-79 (further spread in Malaya). Laidlaw, 1933, Jl. Malayan Branch R. Asiat. Soc., **11**, pt. 2, p. 215. Leefmans and v. d. Vecht, 1933, Algemeen Landbouwweekblad v. Nederl.-Indië, **17**, pt. 47, pp. 878-881, fig. 1 (Rhio

Archipelago: Poelau Bintan. Java: Kebajoran, 12 Kilom. from Batavia); 1933, *De Bergcultures*, **7**, pt. 21, pp. 579-584, figs. 1-3; Pl., figs. 1-2; 1933, *Landbouw, Landbouwkundig Tijdschr. Nederl.-Indië*, **8**, (1932-1933), pt. 10, pp. 668-677; Pl., figs. 1-2. Leefmans, 1933, *Op. cit.*, **9**, (1933-1934), pt. 6, pp. 289-298 (control in Java). Germain, 1934, C. R. 67^e Congrès Soc. Savantes (for 1934), Sciences, pp. 123 and 128. v. Benthem Jutting, 1934, *Jl. of Conch.*, **20**, pt. 2, p. 43 (occurrence in East Indies). Dupont, 1935, *Trans. R. Soc. Arts Sci. Mauritius*, Ser. C, No. 3, (1933-1934), p. 138 (Seychelles: Mahé; Silhouette; Praslin). v. d. Meer Mohr, 1935, *Natur und Volk*, **65**, pp. 62-67 (Sumatra: in 1933 at Tandjong Poera, 65 Kilom. W. of Medan; introduced 12 years before), figs. 1-8 (egg; radula). Viader, 1937, *Mauritius Inst. Bull.*, **1**, pt. 2, p. 86. Heubel, 1937, *De Bergcultures*, **11**, pt. 47, pp. 1667-1669 (spread in Sumatra: Lampong Districts); 1938, *Op. cit.*, **12**, pt. 14, pp. 400-401 (spread in southern Sumatra). Beeley, 1938, *Jl. Rubber Res. Inst. Malaya*, **8**, pt. 2, pp. 130-139, Pl. Pemberton, 1938, *Hawaiian Planters' Record*, **42**, pp. 135-140 (first occurrence in Hawaii in 1936); 2 Pls. Corbett, 1938, *Malayan Agric. Jl.*, **26**, pp. 276-279 (control in Malaya). Connolly, 1939, *Ann. South Afr. Mus.*, **33**, pt. 1, p. 325. Dias and Thamo-theram, 1939, *Tropical Agriculturist*, **92**, pt. 4, pp. 222-223 (control in Ceylon). Pemberton, Williams and Sukimura, 1939, *Proc. Hawaiian Ent. Soc.*, **10**, pt. 2, pp. 187 and 190 (occurrence in Hawaii). Feij, 1940, *De Bergcultures*, **14**, pt. 35, pp. 1112-1114 (occurrence in South Sumatra; control). Cotton, 1940, *South Australian Naturalist*, **20**, pt. 4, p. iii of inside back cover (occurrence in Ceylon). v. d. Meer Mohr, 1940, *De Tropische Natuur*, **29**, pp. 145-148 (occurrence in Sumatra: Medan; Lampong Districts; Palembang); 1941, *Op. cit.*, **30**, p. 173 (occurrence in Sumatra: Atjeh). Kaburaki, 1941, *Proc. 6th Pacific Sci. Congr. (Berkeley, 1939)*, **4**, (1940), p. 230 (introduction into Formosa and Japan). Kuroda, 1941, *Mem. Fac. Sci. Agric. Taihoku Imp. Univ.*, **22**, No. 4, p. 142 (Formosa: "very common in the arable regions"). Esaki and Takahashi, 1942, *Kagaku Nanyo [Sci. South Sea]*, **4**, pt. 3, pp. 16-25 (introduction into Formosa, Japan, the Palaus, Ponape, Tinian, Rota, Yap, and Saipan).¹ Kennard, 1943, *Mauritius Inst. Bull.*, **2**, pt. 3, p. 127 (synonymy). Fernando, 1946, *Ceylon Jl. Sci.*, B, Zoology, **23**, pt. 2, pp. 97-104, figs. 1-9 (storage of galactogen and glycogen by the snail). R. H. Baker, 1946, *Trans. 11th North Amer. Wildlife Conference*, p. 211 (occurrence in Rota, Saipan, Tinian, and Guam). Krauss, 1947, *Proc. Hawaiian Ent. Soc.*, **13**, pt. 1, p. 9 (occurrence in Guam, Rota, Tinian, Saipan, and Ponape; also said to occur near Manila). (Anonymous), 1947, *Pacific Islands Monthly*, **18**, pt. 2, p. 75 (occurrence in New Ireland and New Britain). v. Benthem Jutting, 1948, *Chronica Naturae*, **104**, pt. 5, p. 137. Herklots, 1948, *Food and Flowers*, *Bull. Agric. Dept. Hong Kong Govt.*, No. 1, pp. 1-4, fig. on p. 1 (Sarawak. Southern China: Amoy; Hong Kong). Hanna, 1948, *The*

¹ The original of this article, entirely in Japanese, was shown to me by Mr. Yoshio Kondo in Honolulu. I have perused an English résumé in *Biological Abstracts*, **22**, for 1948, p. 2615.

- Nautilus, **62**, pt. 1, pp. 29-30. v. d. Meer Mohr, 1948, *Chronica Naturae*, **104**, pt. 6, pp. 178-179 (spread in Sumatra from 1940 to 1948). Hubert, 1948, *Op. cit.*, **104**, pt. 6, p. 192, 2 figs. (scalariform abnormality from Java). van Weel, 1948, *Op. cit.*, **104**, pts. 8-9, pp. 241-243, pt. 10, pp. 278-280 (spread and economic importance), and pt. 12, pp. 335-336 (habits; food; growth; longevity; oviposition). Abbott, 1948, *The Nautilus*, **62**, pt. 1, pp. 31-34 (spread in the Orient and Pacific; occurrence in Siam); 1949, *Natural History*, New York, **58**, pt. 2, pp. 68-71, 2 figs. on p. 68 and lower fig. on p. 71. van Weel, 1949, *Chronica Naturae*, **105**, pt. 1, pp. 25-27 (control), and pt. 2, pp. 53-55 (enzymes of digestive gland). Louisa C. Williams, 1949, *Scientific Monthly*, **68**, p. 199. Ley, 1949, *Frontiers*, Philadelphia, **13**, pt. 5, p. 140. v. d. Meer Mohr, 1949, *Treubia*, Buitenzorg, **20**, pt. 1, pp. 1-10 (oviposition and rate of reproduction in Sumatra). (Anonymous), 1949, *Pacific Islands Monthly*, **19**, pt. 9, p. 6. Mead, 1949, *Atlantic Monthly*, **184**, pt. 2 (for August), pp. 38-42. d'Emmerez de Charmoy and Gebert, 1921, *Bull. Ent. Res.*, **12**, pt. 2, p. 182 (damage to cotton seedlings in Mauritius). Reh, 1925, in Sorauer, *Handbuch der Pflanzenkrankheiten*, 4th Ed., **4**, p. 73. Y. Matsui, 1942, *Kagaku Nanyo* [Sci. South Sea], **5**, pt. 1, pp. 137-143 (nocturnal habits in the Palaus). S. Hatai and K. Genji, 1943, *Op. cit.*, **5**, pt. 2, pp. 1-19 (ecology and growth in the Palaus). Allan, 1949, *Australian Mus. Mag.*, **9**, pt. 11, pp. 374-377, fig. (live snail on ship at Sydney in 1948). Zuk, 1949, *Museum and Art Notes*, Vancouver, B. C., (2), **1**, pt. 1, p. 34 (live snail on ship at Vancouver in 1949). v. d. Meer Mohr, 1949, *Chronica Naturae*, **105**, pt. 11, p. 290 (damage to tobacco in Serdang District, N. E. Sumatra). Bryan, 1949, Report Insect Control Committee Micronesia 1947-1948, pp. 7-9, fig. on p. 13 (introduction of East African natural enemies in Hawaii). Vosburgh, 1950, *National Geographic Magazine*, **117**, p. 155 (occurrence in Formosa). Clench, 1950, *News Bull. Ann. Rept. Amer. Mal. Union for 1949*, p. 3.
- Cochlitoma fulica* G. B. Sowerby, 1825, *Cat. Shells Earl Tankerville*, p. 38.
- Helix* (*Cochlitoma*) *fulica* Férussac, 1827, *Bull. Univ. Sci. Nat.*, **10**, p. 203 (description of umbilicate abnormality collected by Rang in Mauritius. Réunion. Madagascar: Ste Marie); 1832 (August 4), *Hist. Nat. Moll. Terr. Fluv.*, Atlas, Pl. 124A, fig. 1 (Plate issued by Férussac in *Livr. 23*, with the name in a printed sheet of Explanation).
- Achatina* (*Archachatina*) *fulica* Albers, 1850, *Die Heliceen*, p. 190.
- Achatina* (*Achatinus*) *fulica* Pfeiffer, 1856, *Malak. Blätt.*, **2**, (1855), p. 168; 1879, *Nomencl. Helic. Viv.*, p. 266. Römer, 1891, *Jahrb. Nassau. Ver. Naturk.*, **44**, p. 123.
- ? *Achatina* (*Achatina*) *fulica* Semper, 1874, *Reisen Arch. Philippinen*, Section 2, *Wiss. Res.*, **3**, pt. 2, p. 143; Pl. 12, fig. 17 (jaw, radula, and anatomy of a specimen supposedly from Calcutta; says that a specimen from Zanzibar agreed with it in every respect).¹

¹ According to Dr. A. R. Mead, the anatomy as described by Semper agrees with that of *A. panthera*, not with that of *fulica*. There is no evidence that *A. panthera* was ever carried to India and its occurrence in Zanzibar is very uncertain. Semper's localities appear to have been erroneous in both cases.

- Agathina fulica* G. Dollfus, 1899, Bull. Soc. Géol. France, (2), **27**, p. 395 (regards it as a rather recent introduction by man into Madagascar from the African mainland).
- ["Agaatslak" Witkamp, 1941, De Tropische Natuur, **30**, pt. 7, pp. 105-108 (occurrence in Dutch Borneo: Koetai)].
- ["Giant African Snail" (Anonymous), 1946, News Bull. Dept. Agric. Commerce Manila, **1**, Nos. 6-7, p. 65; 1947, *Op. cit.*, **1**, No. 11, p. 114 (occurrence and control in the Philippines)].
- ["Giant Snail" (Anonymous), 1947, Pacific Islands Monthly, **18**, pt. 2, p. 33 (New Britain: Kokopo District); 1947, *Op. cit.*, **18**, pt. 3, p. 22 (occurrence in the Marshalls); 1948, *Op. cit.*, **18**, pt. 7, p. 24 (New Britain: Rabaul); 1948, *Op. cit.*, **18**, pt. 12, p. 40; 1948, *Op. cit.*, **19**, pt. 3, p. 49].
- Achatina mauritiana* Lamarek, 1822 (April), Hist. Nat. Anim. Sans Vert., **6**, pt. 2, p. 129 ("Ile de France" = Mauritius. With description and reference to Férussac's *Helix fulva*, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 49 (or 53), No. 347, but not to a figure). Menke, 1829, Verzeichn. Conch.-Samml. Walsburg, p. 7. Quoy and Gaimard, 1831, in Dumont d'Urville, Voy. Astrolabe, Zool., **2**, p. 152; 1834, *Op. cit.*, **3**, pp. 843 and 879 (Explanation of Plates); Atlas, Pl. 11, figs. 10-11 (2 views of shell with animal), 12 (head in front), 13-15 (anatomy); Pl. 49, fig. 21 (anatomy) (specimens from Mauritius). Oken, 1835, Allgem. Naturgesch., **5**, pt. 1, p. 425. Jay, 1836, Cat. Rec. Shells, 2d Ed., p. 42. Deshayes, 1838, in Lamarek, Hist. Nat. Anim. Sans Vert., 2d Ed., **8**, p. 297. Jay, 1839, Cat. Shells Coll., 3d Ed., p. 58. Dufo, 1840, Ann. Sci. Nat., (2), **14**, Zool., p. 198 (Seychelles: Mahé. Animal; egg; umbilicate abnormality). Pfeiffer, 1841, Symbolae Hist. Helic., **1**, p. 28. A. and J. B. Villa, 1841, Dispos. Syst. Conch. Terr. Fluv., p. 19. Sganzin, 1843, Mém. Soc. Hist. Nat. Strasbourg, **3**, pt. 2, Cat. Coq. Iles de France, etc., p. 17 (Réunion. Mauritius). Deshayes, 1844, in Lamarek, Hist. Nat. Anim. Sans Vert., 3d Ed., **3**, p. 375. Leunis, 1844, Synopsis d. Drei Naturreiche, Zool., p. 375. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 165. Keferstein, 1864, in Bronn's Classen u. Ordnungen d. Thier-Reichs, **3**, pt. 2, Pl. 99, fig. 12 (anatomy, after Quoy and Gaimard). Leunis, 1883, Synopsis d. Thierkunde, 3d Ed., (by H. Ludwig), p. 888.
- Achatina (Achatina) mauritiana* Beck, 1837, Index Moll., pt. 1, p. 76 (Madagascar. Mauritius).
- Achatina mauritiana* "Lesson" J. E. Gray, 1859, in Mrs. M. E. Gray, Figures Moll. Anim., **4**, p. 116 (Syst. Arrangement) (Explanation of Pl. 75 of Vol. 1, 1859, copies of Lesson's figures of his *A. couroupa*).
- Achatina acuta* Lamarek, 1822 (April), Hist. Nat. Anim. Sans Vert., **6**, pt. 2, p. 129 ("Sierra Leone", erroneous locality). Menke, 1830, Synopsis Meth. Moll., 2d Ed., p. 28. Deshayes, 1838, in Lamarek, Hist. Nat. Anim. Sans Vert., 2d Ed., **8**, p. 296 (refers to it Férussac's Pl. 124A, figs. 2); 1844, *Op. cit.*, 3d Ed., **3**, p. 375. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 163. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 251. Reeve, 1849, Conch. Icon., **5**, *Achatina*, Pl. 3, fig. 11 (Mauritius). Mörch, 1852, Cat. Conch. Yoldi, **1**, p. 20. Pfeiffer, 1853, Monogr. Helic. Viv., **3**,

- p. 488. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 603. A. D. Brown, 1861, Cat. Shells Coll., p. 55. Haines, 1868, Cat. Terr. Shells Coll., p. 67. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 218; 1876, *Op. cit.*, **8**, p. 275. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 54. Angas, 1877, Proc. Zool. Soc. London, p. 527 (Madagascar: Ekongo on S. E. coast). G. R. Batalha, 1878, Cat. Coll. Conchyl. F. R. Batalha, p. 1. Kobelt, 1880, Illustrirtes Conchylienbuch, **2**, p. 263. Grasset, 1884, Index Test. Viv. Coll., p. 199. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 239. Boucard, 1901, Cat. Coll. Coq. Terr., p. 48. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 40. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 64. Coen, 1945, Catalogo Gasteropodi Polmonati Coll. Coen, p. 42.
- Helix (Cochlitoma) acuta* Férussac, 1832 (August 4), Hist. Nat. Moll. Terr. Fluv., Atlas, Pl. 124A, figs. 2 (2 views of one shell; Pl. issued by Férussac in Livr. 23, with name in printed explanatory sheet, but without locality).
- Achatina (Achatinus) acuta* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 266. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 123.
- Achatina fulvescens* Gray, 1825, Ann. of Philosophy, (N.S.), **9**, p. 414 (no locality; no description; defined by the references to Lister, Pl. 582, fig. 35a, and to Born, Pl. 10, fig. 2). Not of Férussac, 1821.
- Achatina maculata* Deshayes, 1830, Encyclop. Méthod., Vers, **2**, p. 12 (no locality). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 164. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. Not of Swainson, 1821.
- Achatina couroupa* Lesson, 1831, in Duperrey, Voyage Autour du Monde La Coquille, Zool., **2**, pt. 1, p. 318 (Mauritius and Réunion, where it is said to have been introduced from Madagascar); Atlas, Moll., Pl. 9, figs. 2 (animal in shell), 2' (shell), and 2' ' (head in front). Reichenbach, 1842, Land- Stüsswasser- u. See- Conchylien, p. 26; Pl. 6, fig. 156. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 164.
- Achatina borbonica* "Férussac" Lesson, 1831, in Duperrey, Voyage Autour du Monde La Coquille, Zool., **2**, pt. 1, p. 318 (as a synonym of *A. couroupa* Lesson; apparently first valid use of the name).
- Achatina mauritiana* var. *borbonica* "Férussac" Beck, 1837, Index Moll., pt. 1, p. 76 (no locality; with brief description: "ventricosior; lituris fuscis confluentibus").
- Achatina zebra* var. *macrostoma* Beck, 1837, Index Moll., pt. 1, p. 75 (no locality; no description; defined by the reference to Seba, Pl. 71, figs. 4-5).
- Achatina fulva* Deshayes, 1838, in Lamarck, Hist. Nat. Anim. Sans Vert., 2d Ed., **8**, p. 309 (synonymizes with it *A. maculata* Deshayes); 1844, *Op. cit.*, 3d Ed., **3**, p. 379. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 164. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 251 (in part; not the measurements, which are based on Pl. 11, figs. 3-4 of Syst. Conch.-Cab.). Reeve, 1849, Conch. Icon., **5**, *Achatina*, Pl. 3, fig. 10 ("East Africa"). Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 157 ("Sénégalbie"), and Expl. of Plates, p. 18; Atlas, Pl. 124, figs. 1-2 (2

- views of one shell; Pl. published without name by Deshayes after Férussac's death, presumably in 1851). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 488 (description of shell figured by Reeve, Pl. 3, fig. 10). H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 603. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 201. Deshayes, 1863, in Maillard, Notes Ile Réunion, 2d Ed., **2**, Annex E, p. 90 (Réunion). Haines, 1868, Cat. Terr. Shells Coll., p. 67. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 218; 1876, *Op. cit.*, **8**, p. 275. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 53. Clessin, 1878, Jahrb. D. Mal. Ges., **5**, p. 183. Rethaan Macaré, 1888, Cat. Coll. Coq. Mme Rethaan Macaré, p. 23. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 239. Bourguignat, 1889, Moll. Afr. Equat., p. 78 (cites Férussac's Pl. 124, figs. 1-2). Brancsik, 1891, Jahresh. Naturw. Ver. Trencsener Comit., **13-14**, (1890-1891), p. 153 (Madagascar: Nossi-Bé). v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 90 (cites Férussac's Pl. 124, figs. 1-2). Boucard, 1901, Cat. Coll. Coq. Terr., p. 49. Comber, 1906, Jl. Bombay Nat. Hist. Soc., **17**, pt. 1, p. 218 (India: Rajkot). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. Not *Bulinus fulvus* Bruguière, 1792.
- Agathina fasciata* Deshayes, 1831, Diet. Class. Hist. Nat., **17**, p. 121 (Explanation of Pl. 85 of Atlas, showing shell and animal; said to be common at Mauritius, where it is called "couroupa").
- Achatina (Archachatina) fulva* Albers, 1850, Die Heliceen, p. 190.
- Achatina (Achatinus) fulva* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 266.
- Achatina mauritiana* var. *sinistrosa* Grateloup, 1840, Actes Soc. Linn. Bordeaux, **11**, (1839-1840), No. 55, p. 164 (Madagascar).
- Achatina mauritiana* var. *sinistrorsa* Grateloup, 1841, Actes Soc. Linn. Bordeaux, **11**, (1839-1840), No. 56, p. 415 (Madagascar); Pl. 2, fig. 6.
- Achatina fulica* monstr. *sinistrorsum* "Ancey" Dautzenberg, 1911, Jl. de Conchyl., **58**, (1910), p. 316.
- Achatina fulica* var. *monstrosa* Liénard, 1877, Catal. Faune Mal. Maurice, p. 54 (Mauritius; no description). *Nomen nudum*.
- Achatina fulica* var. *scalorioides* G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 145 (Mauritius; no description). *Nomen nudum*.
- Achatina fulica* var. *umbilicata* [G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 145 (shells from Mauritius, without description. *Nomen nudum*)]. Rolle, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 193 (shell from Mauritius; with reference to Reeve's Pl. 11, fig. 8c).
- Achatina fulica* monstr. *umbilicatum* Dautzenberg, 1911, Jl. de Conchyl., **58**, (1910), p. 316 (shells from Madagascar, Mauritius, Seychelles).
- Achatina panthera* Crosse and Fischer, 1889, in Grandidier, Hist. Phys. Nat. Pol. Madagascar, **25**, Moll., Atlas, pt. 1, Pl. 20, figs. 2 (2 views of one shell). Not of Férussac, 1832.
- Achatina rediviva* Mabille, 1901, Bull. Soc. Philom. Paris, (9), **3**, (1900-1901), pt. 2, p. 57 ("Ile de France" = Mauritius). Types figured by Germain, 1921.
- ?*Achatina panthera* var. *chrysoderma* Pilsbry, 1904, Man. of Conch., (2), **17**,

- p. 46 (Mauritius; received from Cuming); Pl. 41, figs. 5-6 (2 cotypes, one from the back, the other in front view). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65.
- Achatina fulica* *monstr. canaliculatum* Dautzenberg, 1911, Jl. de Conchyl., **58**, (1910), p. 315 (based on Rolle's Pl. 17, fig. 3, of 1910).
- Achatina fulica* *monstr. scalaris* Dautzenberg, 1911, Jl. de Conchyl., **58**, (1910), p. 316 (shells from Madagascar, Seychelles: Mahé, and without locality; refers to it also Rolle's Pl. 17, fig. 4, of 1910).
- Achatina panthera* var. *lencostyla* (Anonymous), 1946, The Sphere, (London), **187**, p. 400 (occurrence in New Guinea: Hansa Bay. Also said to have been introduced in New Britain and New Ireland. Not the figures: the shell shown is *A. fulica hamillei*; the eggs are those of a species of *Archachatina*).
- Achatina panthera* var. *leucostyla* (Anonymous), 1948, Pacific Islands Monthly, **18**, pt. 6, p. 71 (New Guinea: Madang. New Britain: Rabaul. New Ireland: Kavieng). Not of Pilsbry, 1904.
- Achatina* sp. Godwin-Austen, 1908, Proc. Mal. Soc. London, **8**, pt. 3, p. 147 (spread near Calcutta in 1876-1877; also at Rajmahal, 170 miles from Calcutta).
- Achatina courouya* Keferstein, 1864, in Bronn's Classen u. Ordnungen d. Thier-Reichs, **3**, pt. 2, Pl. 99, fig. 4 (animal after Lesson. Name in accompanying Explanation of Plate; misspelling of *couroupa* Lesson).

Kennard (1943) has shown that the trivial name *fulica* was first validly proposed by Bowdich (1822), although it was published with a figure only, without a description. This figure, copied in my Pl. 24, fig. 2, is extremely poor, and there is no indication that it was either natural size or reduced. It appears to be an original drawing of a shell, not a copy of an earlier figure; but the type specimen which it shows is lost, so far as known. It is possible to match the figure fairly well with immature examples of *fulica* from Mauritius, assuming that it was reduced. Although no locality was given, the shell came presumably from Mauritius, as did most, if not all, *fulica* found in collections at that time. Férussac's specimen, which I saw at the Paris Museum in 1933, but which is not the type of the species, came from Mauritius, as well as the type of *A. mauritiana* Lamarck. If a type locality is to be designated for the nominate race of *A. fulica*, I propose to take as such Mauritius. As pointed out by Kennard, if Bowdich's figure were ruled unrecognizable or were referred to another species, what is now universally called *fulica* would have to bear the name *A. mauritiana* Lamarck (1822), which antedates the next use of *fulica* by Férussac in 1827 and 1832.

Original description of *A. mauritiana* Lamarck (1822): "A. testa ovato-conica, longitudinaliter striata, albido-lutescente; strigis longitudinalibus confertis rufo-fuscis; spira apice acutiuscula; apertura

albida; labro margine interiore fusco." Length given as 4 inches [=108 mm.]. Dr. G. Mermod states (*in litt.*, 1948) that Lamarck originally had three specimens, one of them in poor condition ("fruste"), according to a marginal note in his own copy of the "Histoire Naturelle", but that there are now only two specimens labelled *A. mauritiana* in the Lamarck Collection at the Geneva Museum. One, of about $7\frac{1}{2}$ whorls, is 83 mm. long, 45 mm. wide, with the aperture 46 by 26 mm.; it is white with brown streaks, somewhat zigzag-like on the penultimate whorl, straight and confluent on the body-whorl, the earliest whorls creamy-white. The other shell is 89 mm. long, 44 mm. wide, with the aperture 46.5 by 25 mm., and is colored like the first. In both the aperture inside, the columella and the outer lip are pale violaceous-white, the parietal callus is weak and the columella is rather markedly twisted. One of the shells has retained the periostracum intact, yolk-yellow, verging to brown. As neither specimen reaches 4 inches, Dr. Mermod suggests that the third, missing shell might have been about that size. Although none of Lamarck's specimens of *mauritiana* have ever been figured, there is little doubt about his species being *A. fulica*, as Deshayes (1838) first recognized.

It may be appropriate to point out that my synonymy of *A. fulica* does not include *Achatina mauritiana* Potiez and Michaud, 1835 (Gal. Moll. Douai, 1, p. 129; Pl. 11, figs. 11-12, two views of one shell). The figures show a pattern of bold, zigzag-like streaks on the body-whorl, which I have never seen in any specimen of *fulica*, or any of its races. They appear to have been drawn from a specimen of *Achatina tineta* Reeve, with which species they agree in shape as well as in pattern.¹

Original description of *A. acuta* Lamarck (1822): "A. testa ovato-conica, elongata, apice acuta, tenuissime decussata, alba; flammis longitudinalibus rubro-castaneis, inferne confertis, subcoalitis, superne separatis; apertura alba." The following remarks are in French: "Beautiful shell, quite distinct in shape and brightly colored. Length, about 5 inches" [=135 mm.]. Lamarck's type is now at the Geneva Museum, where it was examined at my request by Dr. G. Mermod, with the following result. According to a marginal note in Lamarck's own copy of the "Histoire Naturelle", he had only one specimen, the one now at Geneva, bearing written inside a "5" corresponding with the number of *A. acuta* in the book. It has 9 whorls and is 124 mm. long, 57 mm. in greatest width, with the aperture 62 by 32 mm. As

¹ The text and plates of Vol. 1 of the "Galerie des Mollusques de Douai", are generally cited as of 1838, the date printed on the title-page. According to a statement by G. Michaud (1879, Jl. de Conchyl., 27, p. 11), the work appeared in parts, each consisting of a number of plates with the corresponding text. The actual date of publication of each part is the one printed on the plates issued in it. Plate 11 is dated November, 1835.

Pilsbry (1904) correctly inferred, the shell has been polished, at least over the lower portion. It is the original to Férussac's Pl. 124A, figs. 2, one of which is copied in my Pl. 7, fig. 1. They are faithful reproductions, although 3 mm. shorter than the shell. Moreover, Férussac used the name *Helix* (*Cochlitoma*) *acuta* in the explanatory sheet issued with this Plate in 1832. The figures have the usual shape of the nominate race of *A. fulica* and can be matched with some specimens I have seen from Mauritius and the Pacific. The sculpture is that of *fulica* and the columella is white with a slight bluish tinge on the colored figure. Most probably Lamarck's specimen came from Mauritius, as did the type of his *A. mauritiana*.

Original description of *A. maculata* Deshayes (1830) (French text translated): "A. testa ovato-oblonga, ventricosa, obsolete striata, apice obtusa; anfractibus octonis, ultimis fulvo fuscis; maculis fuscis majoribus vel strigis longitudinalibus ornatis, superioribus albidescentibus, flammis fuscatis instructis; apertura spira brevior; columella contorta, alba; labro intus albo, margine interiore fusco. It has relationships with most of the large species [placed at that time in *Achatina*]. It differs at first glance by the more lengthened, less ventricose shape, the much shorter aperture, longer and more convex whorls, the more pointed apex. It has in addition distinctive color. When covered with the periostracum, it is greenish-brown, interrupted by white or dark-brown, longitudinal [vertical], irregularly spaced areas. Toward the apex the ground color is more divided, alternating with more numerous white areas, and changes gradually to brown, flame-like streaks, which decrease little by little and disappear completely at the white tip. There are nine whorls, convex, rounded, smooth or with some obsolete, longitudinal [vertical] striae. The aperture is shorter than the spire; it is bell-shaped, completely white inside, except for the right margin [outer lip], which is very thin, sharp and of the outside color. The columella is entirely white, strongly sinuous in the middle; the basal truncation is not very deep; the columella is shorter than the anterior portion of the right margin. It is $13\frac{1}{2}$ cm. or nearly 5 inches long."¹ I have been unable to trace the present whereabouts of Deshayes' type. Possibly the original name label was destroyed, when the author synonymized it, erroneously in my opinion, with *Bulimus fulvus* Bruguière. See the discussion of *A. achatina monochromatica*. In 1838, in a slightly modified version of the original description, Deshayes gives the length of the type as 140 mm. and now adds the width, as 65 mm. (under *A. fulva*). In 1851, he published an entirely new account (under *A. fulva*), based on several specimens, and stated

¹ "treize millimètres et demi" in the text is an obvious slip of the pen for "treize centimètres et demi," as Deshayes' later accounts show.

that he sent to Cuming the specimen which Reeve (1849) figured as *A. fulva*. He concluded by saying that "The largest specimen which we know is 130 mm. in length and 65 mm. in diameter." He referred to the species Pl. 124, figs. 1-2, of the Atlas to Férussac's work. This Plate was published by himself after Férussac's death, and there is a possibility that it may represent the original type of *A. maculata*, as the measurements are about those indicated for his largest shell in 1851. One of these figures is copied in my Pl. 32, fig. 2. Reeve's figure (copied in my Pl. 32, fig. 1) is of a smaller shell, 120 mm. long, 60 mm. wide, more boldly streaked on the body-whorl. Both figures can be matched among large series of the nominate race of *A. fulica*.

Original description of *A. couroupa* Lesson (1831) (translated from the French): "This *Achatina* varies oddly in size and color. Sometimes a uniform pale chestnut, it may also turn to chestnut with yellow flame-like spots, and then to fair tawny with irregular yellowish flammules, this last condition being the one most commonly found. It is oval, with a lengthened and conical spire, of 7 whorls, the last the largest and very ventricose. The surface is unevenly and almost vertically striate, and the whorls, united by a linear furrow, have on their margins a sort of shagreened suture from which the striae start. The whorls of the spire are slightly convex and end in an obtuse tip. The aperture is high, moderately wide, with a sharp right lip, and curved into a semicircle, while the left lip is replaced by a rolled up and ascending fold of the columella, smooth, bare, and truncate at the top. The average and usual size is 4 inches [= 108 mm.] in length by 20 lines [= 45 mm.] in height [diameter]. The aperture is 2 inches [= 54 mm.] in height by 13 lines [= 29 mm.] in greatest width. Its boldest color is tawny fair with unequal flame-like markings or ill-defined fasciae of deep chestnut. The tip of the spire is most often whitish, with elongate chestnut maculations, brownish in the center and tawny at the margins. When very young the shell is tawny, speckled with chestnut on the last whorl only, the spots on the spire being scarcely indicated. At this age the shell is also more ventricose and much less elongate for its size." What became of the type or types of *A. couroupa* is unknown. Although many of Lesson's types are at the Paris Museum, no shell labeled "*couroupa*" is to be found there now (Dr. E. Fischer, *in litt.*, 1949). One of the original figures is shown in my Pl. 34, fig. 2; it is 114 mm. long, 58 mm. wide, with the aperture 63 by 32 mm., and is a rather obese typical *fulica*. Lesson knew that his species was identical with *A. mauritiana* Lamarck, which he cites in the synonymy, together with *A. castanea* Lamarck, *A. borbonica* Férussac, *A. fulica* Férussac, and *A. zebra* Férussac.

Original description of *A. panthera* var. *chrysoderma* Pilsbry (1904):

"Shell thin and light; white with a few narrow stripes or with diffused patches of red-brown under a bright yellow cuticle on the last whorl, the spire white with broad red-brown streaks, fading on the left. Whorls $7\frac{1}{2}$ or 8. Aperture fleshy-white within, the columella narrow, delicate. Columella and parietal wall covered with a thin white callous. Length 126, diam. 58, aperture 68 mm. Length 115, diam. 56, aperture 62 mm. Apparently mature, yet thin and light, with a thin, white columellar callous." The author referred doubtfully to this form Reeve's *A. fulica* on Pl. 2, fig. 8 (1849), and *A. acuta* on Pl. 3, fig. 11 (1849). Both these figures represent shells from Mauritius and are in my opinion of the nominate race of *A. fulica*. I have examined the types of *chrysoderma* (originally received from Cuming). They are rather large specimens of a form of *A. fulica*, in unusually fresh condition, which accounts for the bright periostracum. If the locality "Mauritius" were to be trusted, they would be referable to the nominate race of the species. The specimens agree, however, better in size and shape with average large shells of the continental *A. fulica hamillei*. It is not impossible that the locality Mauritius was fictitious, as was so often the case for shells distributed by Cuming. For this reason I am listing *chrysoderma* doubtfully as a synonym of typical *fulica*.¹ The two cotypes (Ac.N.S.Phila. No. 4241), respectively 128 and 117 mm. long, are shown in my Pl. 31, figs. 1 and 2.

Original description of *A. rediviva* Mabilie (1901): "Testa magna, late umbilicata, crassa, solida, ovoidea, parum nitente, sub epidermite luteola, decidua, albescente; strigisque rufis, latis, undique strigata, striis longitudinalibus parum perspicuis; spira conico-elata; apice obtuso; anfractibus 7 primis convexo-depressis, sensim et regulariter crescentibus, sutura lineari separatis; ultimo maximo, turgidissimo, fere dimidiam partem altitudinis aequante, ad aperturam paululum descendente, versus suturam sat regulariter crispato; apertura sub-recta, ovato elongata, margine columellari incrassato, ad umbilicum revoluto; externo longe arcuato; columella crassa, torta, ad basin truncata. Alt. 77-82. Diam. 58-67 mill." As recognized by Germain (1921), who figured the types, this supposed species was based on three umbilicate abnormalities of *A. fulica*. I saw these specimens also at the Paris Museum in 1933. A similar shell is shown in my Pl. 20, fig. 2. Pilsbry had previously (1904) placed *A. rediviva* in the synonymy of *A. fulica*.

Specimens of the nominate race of *A. fulica* seem to have reached Europe, probably from Madagascar, from the Seventeenth Century

¹ Germain (1921, p. 180) misunderstood Pilsbry's description, as he states that "the columella, which is narrow and delicate, is also tinted with fleshy-pink." The columella of both types is pure white. Moreover, Pilsbry included his *chrysoderma* among the forms of supposed *panthera* with white columellar margin.

on. The earliest recognizable figures are Lister's (1688) Pl. 578, fig. 33, copied in my Pl. 16, fig. 3, and Pl. 582, fig. 35a, copied in my Pl. 29, fig. 2. Seba's (1758) Pl. 71, figs. 4-5, show two views of one shell, one of the views reproduced in my Pl. 30, fig. 2. Born's (1780) Pl. 10, fig. 2, was drawn from a poorly preserved example and is scarcely recognizable, although it was most probably also *A. fulica*. A copy of this figure would serve no useful purpose.

The nominate, insular race of *A. fulica* is on the average smaller and more slender than the subsp. *hamillei* of the East African mainland, as shown by a comparison of the tables of measurements in the present paper. Most shells do not reach over 120 mm. in length and 55 mm. in greatest width. It varies, however, greatly in size and shape, and it is possible to select exceptional specimens of *hamillei* and of typical *fulica* that fairly agree in both respects. Correlated with the generally more slender outline, the spire of most nominate *fulica* is relatively higher and the aperture shorter, particularly in the largest shells which are usually also the most slender. The wide range of variation in the same territory is well shown by the 3 specimens figured from Madagascar by Crosse and Fischer (1889). One (Pl. 20, fig. 1) is very slender, 104 mm. long and 46 mm. wide; the second (Pl. 21, fig. 1) is moderately elongate, but very large, 146 mm. long, 67 mm. wide; the third (Pl. 20, fig. 2) is short and broad, 91 mm. long and 50 mm. wide (agreeing well with an average *hamillei*), and for this reason was mistaken for an *A. panthera*. The color and pattern exhibit as much variation as size and shape, and it is difficult to find two specimens that are alike in this respect, even in the same colony. In the lighter specimens the ground color is yellowish-brown; this is crossed by broad mahogany or chestnut-brown, vertical streaks, unevenly spaced and of varying width, straight or slightly curved, usually frayed at the edges and occasionally somewhat wavy. The streaks are, as a rule, more distinct on some of the early post-nepionic whorls and tend to fade or to coalesce on the body-whorl. In the darkest specimens the chestnut streaks have fused to cover most of the surface, particularly on the body-whorl, which may then be described as blackish-chestnut with a few narrow, yellowish, vertical streaks. In these dark shells the penultimate and earlier whorls usually preserve the original pattern described above. Sometimes the frayed edges cut deeper into the dark streaks and produce a pattern of irregular, transverse, flame-like spots, very variable in size and shape, giving the shell a speckled rather than a streaked appearance. In a series from Koror Id., in the Palaus, most of the shells are very poorly marked with a few chestnut blotches on a fulvous-yellowish background, perhaps owing to an abnormal or diseased condition. The periostracum is rarely intact in full-grown

shells, but when present it is bright yellow to olivaceous-yellow. After the periostracum is removed, the dark pattern stands out more boldly. The brown vertical streaks are very pale on the first post-nepionic whorls. They are entirely lacking on the nepionic shell, which is at first yellowish-white, later turns almost pure white. The inside of the aperture, the glazed parietal wall, and the columella are white, usually with a slight bluish tinge. Some shells have a more or less distinct blackish-brown margin on the inner edge of the outer lip, but this is far from being a common feature in the adult.

Specimens Examined. MADAGASCAR: without precise locality (Amst.M.; Ac.N.S.Phila.; Berl.M.; Terv.M.; Brus.M.); Bemangidy, Post Manantenina, Fort Dauphin District, Tulear Province (H. Hoogstraal.-M.C.Z.); 40 miles N.W. of Mananjary (W. D. Mateer.-M.C.Z.). — MAURITIUS: without precise locality (U.S.N.M.; A.M.-N.H.; Ac.N.S.Phila.; M.C.Z.; Amst.M.; Brus.M.; Berl.M.; Leid.M.; Brit.M.). — REUNION: without precise locality (M.C.Z.). — COMORO IDS.: without precise locality (M.C.Z.); Anjouan (Berl.M.); Moheli (Berl.M.). — SEYCHELLES: without precise locality (Berl.M.; M.C.Z.). — INDIA: Calcutta (Berl.M.; M.C.Z.). — CEYLON: without precise locality (Berl.M.); Colombo (M.C.Z.). — MALAY PENINSULA: Singapore (W. D. Jellison.-M.C.Z.); Ipoh, Perak (A. E. C. Doscas.-M.C.Z.); Penang (M.C.Z.). — SUMATRA: Palembang (C. T. Brues.-M.C.Z.). — JAVA: Batavia (J. Knock, 1938; J. Sandground, 1939.-M.C.Z.). — PHILIPPINES: Pasay near Manila, Luzon (P. de Mesa.-M.C.Z.). — BISMARCK ARCHIPELAGO: Keravat near Rabaul, New Britain (G. S. Dun.-M.C.Z.). — MARIANAS: Saipan (L. Gates; J. T. Gregory, 1946; H. S. Dybas; W. H. Lange.-Bish.M.; Chic.M.; M.C.Z.); Guam (D. B. Langford, 1946.-Bish.M.; M.C.Z.); Tinian (W. Nutting; J. Helmick; W. H. Lange; R. T. Abbott.-M.C.Z.); Rota (W. H. Lange.-M.C.Z.). — CAROLINES: Ulalu [Romanum], Truk area (D. Anderson, Sept. 1947.-Bish.M.). — PALAU IDS.: Koror (D. B. Langford, 1946; F. X. Williams, 1948.-M.C.Z.); Peleliu (H. S. Dybas, 1945.-Chic.M.); Babelthuap (F. X. Williams, 1948.-M.C.Z.). — OKINAWA JIMA (Loo Choo Ids.): Toyama (C. Parsons, 1945; F. N. Young.-M.C.Z.); Baten Ko (S. L. Kimball.-Bish.M.); Suga, Motobu Mura (F. N. Young.-M.C.Z.); Itokazu (F. G. Werner, 1945.-M.C.Z.). — HAWAIIAN IDS.: Kalihi Valley, Honolulu, Oahu (D. Bryant, 1940.-Bish.M.; M.C.Z.); Pauoa Valley, Honolulu, Oahu (D. T. Fullaway, July 1938.-Bish.M.); Kahala, Honolulu, Oahu (D. T. Fullaway, Jan. 1940.-Bish.M.); Honolulu, Oahu (C. E. Pemberton, 1948.-M.C.Z.); Kaneohe, Oahu (T. S. Uaeda, March 1942; Y. Kondo, Jan. 1848; J. Bequaert, April 1949.-Bish.M.; M.C.Z.). — NEW GUINEA: Hansa Bay (G. S. Dun, 1949.-M.C.Z.). — According to recent reports (1949), the snail

is now very abundant on Chichi Jima, one of the Bonins, in 27° 2' N. Mr. R. T. Abbott also informs me that the U.S.N.M. has a large series collected by L. C. Bulkley at Trang, Siam, in 1937 or 1938. Dr. F. Haas writes me (Jan. 1950) that the Chic.M. has 2 *A. fulica* collected at Setul, Setul Prov., Siam, by C. C. Sanborn, in August, 1949. During the summer of 1949 Dr. A. R. Mead and Mr. Yoshio Kondo found the snail also on Haha Jima, in the Bonins, and on Pagan and Agiguan, in the Marianas. Its introduction in Ponape and Yap was reported by Esaki and Takahashi (1942).

Geographical Distribution. Whether *Achatina fulica* (and *A. panthera*) should be regarded as truly indigenous (autochthonous) or as human importations in Madagascar is difficult to decide. In 1761-1763, Le Gentil (1779, Voyage dans les Mers de l'Inde, etc., 2, p. 412) found *Achatina* in several localities in Madagascar, as shown by the following extract from his account of the land shells (translated from the French): "I found on the peninsula of Fort Dauphin some very beautiful snails shaped like *Buccinum*. They have a thin lip, are $3\frac{1}{2}$ to 4 inches long and only about half that wide in the upper portion, consisting of 8 greyish-white whorls crossed by large fire-colored bands. They live in thorny thickets of a kind very common at Fort Dauphin. These snails have 4 horns; when they retire into their house, they close the entrance with a rather dense tissue or kind of operculum made of a sticky fluid which they sometimes exude. This operculum is easily destroyed as it crumbles between the fingers. I found several of them alive closed up in this fashion. Breaking their operculum awoke them, and they wandered about the room in which they were put for nearly a fortnight, after which they closed up again. After four months in this condition, they were still alive. Another species of snail is also found, similar in many respects to the foregoing, but once again larger; it has a very thick lip and is less common. I found none of it with the animal or with the original color. Perhaps this snail is only the first species having died of old age." In the same work he states later (2, p. 471), where he describes Antongil Bay: "I also found the species of *Buccinum* snail of which I spoke at the article of Fort Dauphin. Apparently this snail is spread along the entire coast. I saw some at Foulpointe, at Sainte Marie islet and at Marotte islet.¹ Later some were given to me at Mauritius which came from Mozambique. These were once again larger than those I obtained in Madagascar." From these statements *Achatina*, possibly of two species, were common about 1760 in Madagascar; the smaller snails mentioned were clearly *A. fulica*; the larger ones may have been

¹ Marotte is a very small islet in Antongil Bay.

A. panthera. Germain (1921, Ann. de Paléontologie, 10, p. 53) is strongly of the opinion that both *A. fulica* and *A. panthera* are recent arrivals in Madagascar and most probably accidental introductions by man. This he concludes from the absence of remains of *Achatina* in late Pleistocene deposits of the island, some of them containing terrestrial shells in fair abundance. Collections of these shells, which he examined, belonged mostly to characteristic endemic recent Madagascar snails, often scarcely separable from them. G. Dollfus (1899) previously expressed the same opinion as Germain. Although I am inclined to agree with them, it should be pointed out, nevertheless, that some fossil remains attributed to *Achatina* have been recorded by Newton (1895, Quart. Jour. Geol. Soc. London, 51, pt. 1, pp. 72 and 87) from supposedly Pleistocene ("Quaternary") deposits capping a hill at Ambohimarina in northern Madagascar. Some of these remains were definitely referred to *A. panthera*. I am unable to evaluate the significance of this find. It may well be that these fossils were actually not as old as Newton believed.

It seems an established fact that *A. fulica* did not occur in Mauritius much before the year 1800. It was not there in 1760-1769, when Le Gentil spent considerable time in this island. A few years later Bernardin de St. Pierre, who lived there some time, does not mention it in his well-known relation (1773, Voyage à l'Isle de France). This book contains (vol. 1, pp. 147-151) a long list of marine, fluviatile and terrestrial snails, which the author seems to have collected with predilection. Yet no mention is made of anything resembling *A. fulica*, a snail he could hardly have missed. The earliest published account I was able to trace of *Achatina* in Mauritius, is by Bosc in 1803 (Nouveau Dict. Hist. Nat., 1, p. 134; translated from the French): "I have heard from an inhabitant of Mauritius that the wife of a governor of the island, ailing of the chest, had on doctors' orders fetched from Madagascar many of these snails [*Achatina*, referred by error to *A. achatina* by Bosc], since there were none in this part of the colony.¹ She died shortly after and the snails spread over the island, increasing to the extent of becoming a calamity. They have been hunted several times, but they are even now very common." Lesson also (1831) found *A. fulica* (which he called *A. couroupa*) very common when he visited Mauritius in 1824. At the time of Quoy and Gaimard's (1831) visit in 1828, the snail had become a pest. They note that "one cannot travel without seeing heaps of their shells at the edges of the fields." They mention also that the shells showed numerous variations "which probably may have led to exaggerate the number of species."

¹ The same tale is recounted by several later writers, such as Férussac (1827), Lesson (1831), and Benson (1858).

In more recent years its economic importance seems to have become negligible there, as I can find no further complaints about it in the recent literature dealing with the mollusks of Mauritius. It might perhaps be worth investigating how this change was brought about.

From Mauritius *A. fulica* reached Réunion a few years later, as Férussac (1821 and 1827) saw specimens from there. In 1840 Dufo recorded it from the Seychelles. The earliest mention from the Comoros is by Morelet in 1860. According to Benson (1858), it was first carried from Mauritius to India in April, 1847, when he released some of the snails in the garden of the Asiatic Society of Bengal, at Calcutta. In 1848, Hutton took some of the Calcutta snails to Mussoori, in the foothills of the Himalayas.

At first the spread of the snail in southern Asia was very slow. It was reported in 1910 from Ceylon by E. E. Green, who relates that some living specimens had been liberated about 1900 near Watawala by one Oliver Collett. By 1910 the snail was particularly abundant in the Kalutara area. Early in 1922 it was observed in several localities of the Malay Peninsula, particularly in Singapore (Jarrett, 1923), Perak, Johore and Kelantan (Birkinshaw, 1928); but F. W. South (1926) believes that it may have been in Malaya since 1910 or 1911. It was introduced in Sarawak, Borneo, about 1928 (Jarrett, 1931), in Dutch Borneo about 1939 (Witkamp, 1941), and in Southern China near Amoy in 1931 (Jarrett, 1931) and from there to Hong Kong about 1941 (Herklots, 1948). It had reached Siam by 1937-1938, according to R. T. Abbott (*in litt.*). Up to 1932 it was thought not to occur anywhere within the Dutch East Indies, but it had actually been introduced some time before, probably about 1921, into Sumatra, although it was not noticed there until July, 1933, near Tandjong Poera, 65 Kilom. N.E. of Medan (v. d. Meer Mohr, 1935 and 1940). Toward the end of 1932 or early in 1933 it was found in the Rhio Archipelago and near Kebajoran, Java (Leefmans and v. d. Vecht, 1933). Esaki and Takahashi (1942) state that it was brought from Singapore to Formosa in January, 1932, and that its introduction and rearing were forbidden there in 1936; but, according to Kuroda (1941), it is now very common in the cultivated sections of Formosa. Esaki and Takahashi also mention that the snail was brought to Japan proper in 1925, carried from there to the Palau Ids. in 1938, and later also to Ponape, Tinian, Rota, Yap and Saipan. It is now extremely abundant in most of these Micronesian islands. Kaburaki asserts (1941) that, although the snail was often brought to Japan since 1936, it did not become established there "owing to the unfavorable climatic conditions." This does not apply, however, to the Loo Choo Ids., where the Americans found *A. fulica* to be fairly common in 1945 in

Okinawa. Possibly this island may be the northernmost point reached at present by the snail (nearly 27° N.). It was carried from Formosa to the Philippines during the Japanese occupation (1943-1945) and is now found at various places near Manila.¹ The earliest known occurrence in Hawaii was in 1936 (Pemberton, 1938). Although drastic control measures were taken almost at once, it spread rapidly in Oahu, where it is now a serious agricultural problem. According to Pemberton, 12 snails had been imported from Japan in November, 1936, to Makawao, Maui. In April, 1938, six snails of the Maui stock were transported to Honolulu, but these were promptly destroyed. The present *Achatina* colonies of Oahu appear to be the progeny of two snails brought to Honolulu from Formosa in 1936. In April, 1949, I could find no trace of the several foci of *fulica* at one time present within the city limits of Honolulu; but a moderate number of snails were observed in the eastern section of Oahu, near Kaneohe, during a visit made with Mr. Yoshio Kondo and Mr. P. W. Weber. R. T. Abbott (1948) relates that the snail was imported accidentally with *Pandanus* leaves into Guam from Saipan in 1946; a year later it had spread over most of the southern half of the island. Anonymous reports in "The Sphere" (1946) and the "Pacific Islands Monthly" (1948) mention its occurrence in British New Guinea (Madang and Hansa Bay) and the Bismarck Archipelago (New Ireland and New Britain). In a recent letter to Mr. R. T. Abbott (June, 1949), Mr. G. S. Dun, Entomologist at the Department of Agriculture, Territory of Papua-New Guinea, states that there are at present only three original points of infestation in that area. The first, at Hansa Bay on the North-East Coast of New Guinea, extends some 20 miles along the coast and some 10 miles inland. The second, in New Britain, is limited to the northern half of the Gazelle Peninsula. The third, in New Ireland, spread from Kavieng on the most northerly tip a limited distance down the western and about 40 miles down the eastern coast.

The foregoing account shows that the spread of *A. fulica* from its original continental African home and Madagascar to the islands of the Indian Ocean, India; the Orient, the East Indies and the Pacific Islands is entirely due to transport by man, usually deliberate, in a few cases accidental. Furthermore all later importations may be traced back ultimately to the first introduction from Madagascar into Mauritius, some 150 years ago.

According to R. T. Abbott (1948), a few live *A. fulica* were found in 1946 or 1947 in gardens at San Pedro, California, presumably intro-

¹ Various anonymous reports (1946; 1947). Mr. R. T. Abbott informs me that the occurrence of the snail in the Philippines is mentioned by Abada in a mimeographed Bulletin of the Bureau of Education in Manila (1946, 6, 8, No. 19075).

duced accidentally from the Pacific area. Although the snails were promptly destroyed, they caused much apprehension locally and induced the Department of Agriculture of the state to enforce stringent measures in order to prevent further importations. As a result the snail was intercepted on several later shipments of military supplies returned from the Pacific Islands. It is, in my opinion, extremely doubtful that *A. fulica* could ever become established in California or elsewhere in the continental United States, to judge from the present distribution and the ecology of this snail. Like most other Achatininae, *A. fulica* is for all practical purposes a typical tropical snail. The known distribution in its original East African home, between lat. N. $7^{\circ} 30'$ and lat. S. 17° , is well within the tropics. This is true also for most of the areas to which it has spread, with the exceptions of Okinawa and the Bonins (lat. N. 26° to 27°). The latter have an unusually warm climate for the latitude, owing to the powerful hot Northern Equatorial Current. Wherever it occurs, the snail keeps to the hot lowlands and the warm temperate lower slopes of the mountains. It evidently needs a combination of a constantly high temperature, well above freezing the year round, and much humidity at least during part of the year, the drier months being spent in dormant estivation. At the same time it is averse to sunshine, exposure to the direct rays of the sun killing it off rapidly. Conditions essential to the permanent survival of *A. fulica* do not seem to occur anywhere in the continental United States, no part of which is completely free at all times of winter frosts; while, in addition, most of the warmer areas are deficient in rainfall or lack protection against the sun. Nevertheless controlled experiments, under strict supervision, but under natural conditions in a presumably favorable area, are called for in order to determine once and for all whether or not the snail could survive the winter and reproduce freely in the United States. Meanwhile it might be unwise to relax present measures to prevent its importation.

The real danger of further spread of the snail would seem to be to Central and South America and the West Indies, where many sections apparently offer ideal conditions for its permanent establishment and its possibly becoming a major agricultural pest. It is nevertheless remarkable that during the past four and a half centuries no African species of *Achatina* or related genera has become established in the New World tropics, although some live specimens must occasionally have been transported across the tropical Atlantic.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Length		
171 mm.	81	74	42.5	8 $\frac{2}{3}$		Locality unknown
151	73	70	38.5	8		Keravat
131	59	62	30.5	8		Guam
128	57.5	59	32	8		Honolulu
118	52.5	55	28.5	8		Colombo
118	54	56	28.5	8		Perak
116.5	63	60.5	33	7 $\frac{3}{4}$		Guam
112	59	56	31	7 $\frac{3}{4}$		Mauritius
112	55	55.5	30.5	7 $\frac{1}{2}$		Honolulu
111.5	46	53	25	7 $\frac{1}{2}$		Mauritius
109.5	51	52	28	8		Singapore
106	55.5	55	29	7 $\frac{1}{2}$		Honolulu
106	53.5	54.5	30	7 $\frac{3}{4}$		Okinawa
105	52	52.5	27	7 $\frac{1}{2}$		Mauritius
103.5	55.5	52	31	7 $\frac{3}{4}$		Rizal
103.5	51	52	26	7 $\frac{1}{2}$		Babelthuap
102	49	49	28	7 $\frac{1}{2}$		Mauritius
101.5	45	49	25	7 $\frac{1}{2}$		"
101	52	53	29.5	7 $\frac{1}{2}$		Penang
100	51	50.5	27	7 $\frac{1}{2}$		Mauritius
98	50	52	27	7 $\frac{3}{4}$		Manila
98	46	48.5	24.5	7 $\frac{1}{2}$		Bemangidy
97	52	50	25.5	7 $\frac{1}{2}$		Koror
91.5	40	44	22	7 $\frac{1}{3}$		Comoros
91	48	49	26.5	7 $\frac{1}{3}$		Manila
89	43	44	23	7 $\frac{1}{2}$		Koror
88	42.5	46	22	7		Saipan
86.5	44	44.5	23.5	7		Batavia
85	45	46.5	22	7 $\frac{1}{2}$		Koror
80.5	43	42.5	22	7 $\frac{1}{3}$		Rota
77.5	40.5	41.5	21.5	7		Koror
75	41	41	21	7		"
72	37.5	38.5	19	7		"

The largest shell seen (171 mm.) is very slender, approaching in shape Deshayes' (1851, in Férussac) Pl. 124, figs. 1-2, but with the spire more drawn out.

The average length of the nominate race of *fulica* is about 110 mm., with an average greatest width of about 50 mm. My measurements show that relatively slender shells predominate in this race. Specimens over 120 mm. in length are scarce. Some of the largest were figured by the early writers. Deshayes' Pl. 124, fig. 1, is 133 mm. long and

67 mm. wide, but is fairly matched by a shell from Guam (M.C.Z.). Reeve's Pl. 3, fig. 11 (as *A. acuta*, from Mauritius) is 136.5 mm. long, 61 mm. wide. Crosse and Fischer's Pl. 21, fig. 1 (from Madagascar) exceeds both of these, being 146 mm. in length and 67 mm. in greatest width. No doubt these shells had been selected for their unusual size, which has a special appeal to collectors. F. W. South (1926) states that in Malaya the full-grown snail averages 4 to 5 inches, with an occasional specimen $6\frac{1}{2}$ inches (170 mm.) in length. In some of the Pacific Islands, notably in the Palaus, *A. fulica* is usually stunted; the average length of 10 specimens, apparently adult (of 7 to $7\frac{1}{2}$ whorls), from Koror Id., is about 83 mm.; the dwarfed condition may be due to a disease of the snails. Two of these shells are shown in my Pl. 25, fig. 1, and Pl. 36, fig. 1.

An unusually broad shell from Perak (Pl. 23, fig. 4) is not included in my table of measurements; it is 98.5 by 57 mm. and seems to be somewhat deformed. Abnormal shells are, moreover, by no means rare in collections, no doubt because of the abundance of the snails in certain localities. Most of these seem to come from Mauritius, however; and I have as yet seen no sinistral, umbilicate or scalariform specimens from the Orient or the Pacific. Pl. 20, fig. 2, shows an umbilicate, and Pl. 22, fig. 1, a scalariform shell, both from Mauritius.

Mr. Yoshio Kondo informs me (*in litt.*, Nov. 1949) that in 1949 he obtained a sinistral *A. fulica* on Pagan, in the Marianas. This appears to be the third, or possibly fourth, sinistral specimen known of the species. The first was reported by Grateloup (1840, 1841) from Madagascar. Smith's (1908) specimen from the British Museum (locality not given) may have been Grateloup's. Spence (1926), however, had another shell from Mauritius. The other references to sinistrality in *fulica*, by Ancey (1906) and Dautzenberg (1911, 1914), were based on Grateloup's record.

b. *A. FULICA CASTANEA* Lamareck

Pl. 7, fig. 3; Pl. 22, fig. 4; Pl. 54, fig. 3

Achatina castanea Lamareck, 1822 (April), Hist. Nat. Anim. Sans Vert., 6, pt. 2, p. 130 (no locality). Deshayes, 1838, in Lamareck, *Op. cit.*, 2d Ed., 8, p. 297; 1844, in Lamareck, *Op. cit.*, 3d Ed., 3, p. 375. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 163. Pilsbry, 1904, Man. of Conch., (2), 17, p. 54; Pl. 15, fig. 8 only (after Férussac's Pl. 125, fig. 5). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 65.

Helix (Cochlitoma) zebrina Férussac [1821 (May ?), Tabl. Syst. Moll., Tabl. Limaçons, p. 49 (or p. 53) (no locality; no description; no reference). *Nomen nudum*]; 1823 (September 27), Hist. Nat. Moll. Terr. Fluv., Atlas,

Pl. 125, figs. 3-4 (2 views of one shell) and 5 (another specimen) (Plate published in Livr. 20, with name printed on cover). Kennard, 1942, Proc. Mal. Soc. London, **25**, pt. 1, p. 15.

Achatina fulica var. β Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 254 (with *A. zebrina* Férussac as a synonym and a reference to Férussac's Pl. 125, figs. 3-5).

Original description of *A. castanea* Lamarck: "A. testa ovata, ventricosa, tenuissime striata, nitida, castanea, apice albida; suturis linea alba marginatis; labro intus albo." The following remarks are added in French: "The upper half of the last whorl is a beautiful chestnut, while the lower half is a paler russet. Length, 2 inches 8 lines." [=72 mm.]. Dr. G. Mermod writes that the only specimen now labelled *castanea* in Lamarck's collection at the Geneva Museum and evidently the type of this race, is 67 mm. long, 39 mm. wide, with the aperture 39 by 20 mm. It is the specimen figured by Férussac on the latter's Pl. 125, fig. 5, as v. Martens (1897) and Pilsbry (1904) surmised. Dr. Mermod says: "This figure is a faithful reproduction, except for the color of the upper portion of the body-whorl which is too dark on the figure. It may be noted, in addition, that the transverse dividing line between the two contrasting colors of the body-whorl corresponds also to a very blunt carina, distinct especially on the prolongation of the suture over the whorl. The aperture is white, somewhat violaceous-pinkish; the area of the callus [parietal wall], almost non-existent, is dark brown." No locality was originally given, either by Lamarck or by Férussac. In view of the fact that Férussac had received specimens of *A. fulica* from Madagascar, Mauritius and Réunion, it seems reasonable to assume that the originals to his Pl. 125, figs. 3-5, came from this insular area. I have reached the conclusion that the two shells he figured were dwarfed or immature specimens of a peculiar color phase of *A. fulica*, with which they agree in outline and apparently also in sculpture. The slight carination at the periphery of the last whorl, noted by Dr. Mermod, would seem to indicate that this specimen at any rate (fig. 5) was immature. The shell shown in figs. 3-4 is somewhat transitional to the usual color pattern of *fulica*, and I have seen specimens from Saipan, Rota and elsewhere exhibiting a tendency toward the production of narrow, incomplete streaks or even toward a division of the body-whorl into two zones of contrasting color. None I have seen, however, show the broad dark-brown parietal callus and outer edge of the columella, which I regard as characteristic for *castanea*. These are also present in Lamarck's type (as noted by Dr. Mermod), shown in Férussac's fig. 5 from the back only. It is mainly owing to this peculiarity that I retain *castanae* as a distinct subspecies of *A. fulica*, and refer to it both specimens shown in

Férussac's Pl. 125, figs. 3-5. These figures are copied in my Pl. 17, fig. 3, Pl. 22, fig. 4, and Pl. 54, fig. 3.

I do not include in my bibliography of *A. fulica castanea* references to v. Martens' *Achatina castanea* (1897, Deutsch-Ost-Afrika, 4, Beschalte Weichth., p. 88; lower 2 figs. on p. 87, 2 views of a shell from the cultivated zone at the foot of Mt. Kilimanjaro, Tanganyika Territory). These figures were copied by Pilsbry (1904, Man. of Conch., (2), 17, Pl. 15, figs. 7 and 9) and by Germain (1923, Voy. Afr. Orient. Angl. 1913 G. Babault, p. 74, fig. 24). They represent a shell differing in shape and sculpture from any form of *A. fulica* I am acquainted with, and also lacking the dark brown parietal callus of true *castanea*. I have seen this specimen at the Berlin Museum in 1933. It appears to be a form or color phase of *A. bloeyti* Bourguignat. I have seen specimens of *bloeyti*, similarly colored, collected by Mr. A. Loveridge at Kilwezi and other localities of Kenya Colony toward Mt. Kilimanjaro.

My interpretation of Lamarek's *castanea* as an unusual color form of *A. fulica* must necessarily remain tentative, as I have as yet seen no actual shell that agrees exactly with either of Férussac's specimens.

C. A. FULICA COLOBA Pilsbry

Pl. 27, fig. 3

Achatina fulica var. *coloba* Pilsbry, 1904, Man. of Conch., (2), 17, p. 58 (no locality); Pl. 37, fig. 21 (holotype). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 65.

Original description of *A. fulica* var. *coloba* Pilsbry (1904): "Similar to *fulica* in shape and texture, but differing in the extremely small size. Yellowish, copiously streaked with red-brown, the streaks unequal, narrow and straight on the last whorl, wider on the penult.; whorls 7, the last three puckered below the sutures. Length 58, diam. 30.5, aperture 29 mm. Based upon two adult shells, 54 and 58 mm. long and a young specimen." I have seen the two type specimens at Ac.N.S.Phila. (No. 30266), the one figured by Pilsbry (58 mm.) being shown in my Pl. 27, fig. 3. They are now labelled "West Africa", clearly an erroneous locality, since they are merely dwarf specimens of *A. fulica*, as Pilsbry recognized. I retain the name provisionally with subspecific status, as I can throw no further light on it at present. All other small adult specimens of *fulica* I have seen were considerably larger than Pilsbry's shells, the smallest being 72 mm. long. They are clearly connected by gradually larger adults with specimens of average size of the nominate race, being also found in the same localities with larger shells.

d. *A. FULICA HAMILLEI* Petit

Pl. 15, fig. 2; Pl. 19, figs. 2 and 4; Pl. 40, fig. 3; Pl. 42, fig. 1;
 Pl. 43, fig. 1; Pl. 45, fig. 2; Pl. 46, fig. 2; Pl. 47, figs. 1 and 3;
 Pl. 48, fig. 1; Pl. 49, fig. 2; Pl. 50, figs. 1-2; Pl. 55, fig. 3;
 Pl. 78, figs. 2-3; Pl. 79, fig. 2; Pl. 80, figs. 1-3 and 5

Achatina hamillei Petit, 1859, Jl. de Conchyl., **7**, p. 384 ("West Coast of Africa, probably near Gambia;" erroneous locality); Pl. 13, fig. 3. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 201. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 212; 1876, *Op. cit.*, **8**, p. 272. E. A. Smith, 1881, Proc. Zool. Soc. London, p. 282; Pl. 32, fig. 10 (Tanganyika Territory: Usambara). Pelseneer, 1886, Bull. Mus. Hist. Nat. Belgique, **4**, p. 104 (Tanganyika Territory: between the East Coast and Lake Tanganyika). Bourguignat, 1889, Moll. Afr. Equat., p. 75. v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 86, upper 2 figs. on p. 87 (Zanzibar Id.: Mojoní. Tanganyika Territory: Tanga; between Simbaweni and Koo in Usegua; Mkurumu in the Masai Steppe); 1897, Arch. f. Naturgesch., **63**, pt. 1, p. 54; 1897, Mitt. Naturh. Mus. Hamburg, **14**, p. 114 (1901, Zool. Ergebn. Küstengebiete Ost-Afrika Reise Stuhlmann, **2**, pt. 15, p. 4). E. A. Smith, 1899, Proc. Zool. Soc. London, p. 590 (Nyasaland. Tanganyika Territory: Usambara). Aneey, 1902, Jl. de Conchyl., **50**, p. 273 (Tanganyika Territory: valley of the Malagarazi River in Unyanyembe. Says Petit's type came most probably from Zanzibar or the East African coast). Pilsbry, 1904, Man. of Conch., (2), **17**, p. 53; Pl. 8, figs. 21 (after Petit) and 22 (after E. A. Smith). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. Menezel-Ben-Tovim, 1934, Arch. f. Naturgesch., (N. F.), **3**, pp. 64, 87, and 112 (cutaneous glands; Semper's glands). Germain, 1935, Mem. Est. Mus. Zool. Univ. Coimbra, Ser. I, No. 80, p. 40 (Portuguese East Africa: Nova Choupanga near Chemba). Frömming, 1940, Arch. f. Molluskenk., **72**, pp. 158-160; 1941, *Op. cit.*, **73**, pp. 151-154 and 195-200 (food preferences in captivity).

Achatina (Achatinus) hamillei Pfeiffer, 1879, Nomencl. Helic. Viv., p. 264.

Achatina hammillei Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 239 (misspelling of *hamillei*).

Achatina panthera v. Martens, 1859, Malak. Blätt., **6**, p. 214 (var. with white columella from Portuguese East Africa: Querimba Ids.); 1879, Monatsber. Ak. Wiss. Berlin, p. 737 (in part: shells from Querimba Ids.). Bourguignat, 1879, Descr. Moll. Egypte Abyssinie Zanzibar, p. 9 (Nasimoya in Zanzibar). v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 84 (var. with white columella from Zanzibar Id. and Tanganyika Territory: Bagamoyo); 1897, Arch. f. Naturgesch., **63**, pt. 1, p. 54. Neville and Anthony, 1906, Bull. Soc. Philom. Paris, (9), **8**, pt. 6, p. 295, fig. 2 (dead, weathered shell from near Lake Rudolf); 1906, Bull. Mus. Hist. Nat. Paris, **12**, p. 410. Piersanti, 1941, Missione Biologica Sagan-Omo, **12**, (Zoologia, 6), p. 272; Pl., fig. 26 (Southern Abyssinia: mouth of the Omo River in Lake Rudolf). Not of Férussac, 1832.

- Achatina fulica* Gibbons, 1879, Jl. of Conch., **2**, p. 143 (Zanzibar Id.). Pfeiffer, 1889, Jahrb. Hamburg. Wiss. Anst., **6**, pt. 2, p. 24 (Zanzibar Id. Tanganyika Territory: Bagamoyo). v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 89 (Zanzibar Id.); 1897, Arch. f. Naturgesch., **63**, pt. 1, p. 54; 1897, Mitt. Naturh. Mus. Hamburg, **14**, p. 114 (1901, Zool. Ergebn. Küstengebiete Ost-Afrika Reise Stuhlmann, **2**, pt. 15, p. 4) (Zanzibar Id.). Connolly, 1925, Trans. R. Soc. South Africa, **12**, pt. 3, p. 169 (Portuguese East Africa: S. of Mt. Dedza near Nyasaland border); 1928, Atti Soc. Nat. Mat. Modena, (6), **7**, (or vol. **59**), p. 127 (Italian Somaliland: between Gumbo and Bieja). Haas, 1929, Zool. Jahrb., Abt. Syst., **57**, pp. 389 and 392 (specimens from Pemba Id., Fundu Id. near Pemba, Mafia Id., Lamu Id.). Bacci, 1939, Ann. Mus. Civ. Genova, **58**, p. 335, fig. 1 (anatomy. Italian Somaliland: Magala Umberto I on Uebi River; Baidao). Burton, 1949, Illustrated London News, **214**, p. 120, top fig. (alive in London, from East Africa). Not of Bowdich, 1822.
- Achatina letourneuxi* Bourguignat, 1879, Descr. Moll. Egypte Abyssinie Zanzibar, p. 8 (Nasimoya in Zanzibar). Kobelt, 1881, Synopsis Moll. Viv. Test. 1879 Promulgat., p. 137. Bourguignat, 1889, Moll. Afr. Equat., p. 79 (Zanzibar Id.; "Zanguebar" = coast of Tanganyika Territory; "Coast of the Benadir" = southern section of Italian Somaliland). Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240. v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 84; 1897, Arch. f. Naturgesch., **63**, pt. 1, p. 54. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 49. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65.
- Achatina panthera* var. *nasimoyensis* Bourguignat, 1879, Descr. Moll. Egypte Abyssinie Zanzibar, p. 9 (no locality; presumably from Nasimoya in Zanzibar). Pilsbry, 1904, Man. of Conch., (2), **17**, p. 44. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66.
- Achatina milne-edwardsiana* Révoil, 1885, Bull. Soc. Mal. France, **2**, p. 98 (Italian Somaliland: valley of Uebi River above Gueledi, 4 days travel from Mogadischu [or Mogdishu], type locality. Tanganyika Territory: Usagara); Pl. 5 (paratype from Usagara). Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240. Ancey, 1894, Mém. Soc. Zool. France, **7**, p. 220. v. Martens, 1895, Ann. Mus. Civ. Genova, **35**, p. 64 (Italian Somaliland: between Bardera and Brava on the Juba River); 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 83 (refers to it also a shell from Portuguese East Africa: Querimba Ids.); 1897, Arch. f. Naturgesch., **63**, pt. 1, p. 54. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 38; Pl. 14, fig. 4 (after Révoil). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65.
- H. Wagner, 1940, Veröffentl. D. Kolonial Uebersee Mus. Bremen, **3**, pt. 1, p. 93, fig. 1 on p. 96 (Tanganyika Territory: Arusha-Chini near Mt. Kilimanjaro); 1941, Rivista Biol. Colon., **4**, pt. 3, p. 119, fig. 4 on p. 127; 1941, Ann. Mus. Nat. Hungarici, Zool., **34**, p. 82; Pl. 2, fig. 3. Burton, 1949, Illustrated London News, **214**, p. 120.
- Achatina milne-edwardsi* Bourguignat, 1889, Moll. Afr. Equat., p. 79.
- Achatina pantherina* v. Martens, 1897, Mitt. Naturh. Mus. Hamburg, **14**, p. 114 (1901, Zool. Ergebn. Küstengebiete Ost-Afrika Reise Stuhlmann,

- 2, pt. 15, p. 4) (in part: shell from Zanzibar Id. with white columella).
Not of G. Nevill, 1879.
- Achatina panthera* var. *neumannii* v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 84, fig. (Zanzibar Id.: Jambiani); 1897, Arch. f. Naturgesch., **63**, pt. 1, p. 54. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 45; Pl. 42, fig. 9 (after v. Martens). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66.
- Achatina panthera* var. *leucostyla* Pilsbry, 1904, Man. of Conch., (2), **17**, p. 45 (Kenya Colony: Wasin Id., close to the Coast, S. of Mombasa); Pl. 39, fig. 33 (cotype); Pl. 40, figs. 2 (cotype) and 3 (cotype). Kobelt, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. d'Ailly, 1910, in Sjöstedt, Kilimandjaro Meru Exped., **1**, Abt. 6, p. 21 (Tanganyika Territory: Tanga).
- Achatina leucostyla* Pilsbry, 1905, Man. of Conch., (2), **17**, pp. xi and xiii of Introduction (animal; anatomy); pp. 216, 226, and 232 (as a species); Pl. 64, figs. 65-66 (anatomy).
- Achatina* (*Achatina*) *leucostyla* Dautzenberg and Germain, 1914, Rev. Zool. Afric., **4**, pt. 1, p. 25 (Tanganyika Territory: Dar-es-Salaam).
- Achatina panthera leucostyla* Haas, 1929, Zool. Jahrb., Abt. Syst., **57**, p. 389 (Tanganyika Territory: Mafia Id.).
- Achatina fulva* E. A. Smith, 1894, Proc. Mal. Soc. London, **1**, pt. 4, p. 165 (Kenya Colony: Mkonumbi near Witu). Not *Bulimus fulvus* Bruguière, 1792.
- Achatina acuta* C. R. Boettger, 1947, Arch. f. Molluskenk., **76**, p. 97; Pl. 2, fig. 6 (Tanganyika Territory: in Pleistocene deposits on the Garussi River, N.W. of Lake Njarasa [=Nyaraza or Eyasi]; also Recent shells from Amani). Not of Lamarek, 1822.

Original description of *A. hamillei* Petit (1859) (French text translated): "A. testa conico-ovata, ad basin ventricosa, strigis castaneis undatis picta: spira acuminata; anfractibus 7-8, subrotundatis, superioribus plus minusve subtiliter decussatis, ultimo sublaevigato, ad suturam marginato: columella contorta, truncata; caerulescente albida: labro simplici. Length, 90 mm.; width, 50 mm. Shell ovate-conical, rather ventricose, with a relatively short and acuminate spire; upper whorls slightly decussate; columella and inside of aperture bluish-white; right margin [outer lip] thin. The color of the shell, covered with a strong periostracum, approaches that of *A. marginata* Swainson, but that species has the right margin [outer lip] thick and the spire obtuse, whereas our shell has the right margin [outer lip] thin and the spire more pyramidal. The color of the columella also differs; there is one whorl more." Described from a single type, which I saw in the collection of the "Journal de Conchyliologie," in 1933, when it was in the custody of the late Mr. P. Dautzenberg. This collection is now in the care of Dr. E. Fischer-Piette, who sent me the photograph of my Pl. 78, fig. 2. The original figure is copied in my Pl. 19, fig. 2. The

type is an immature, medium-sized specimen of the common continental East African form of *A. fulica*, lacking the nepionic whorls. It can be matched with immature specimens collected by Dr. F. X. Williams in Zanzibar (compare my Pl. 80, fig. 2). The periostracum is usually well preserved in young shells of this species. E. A. Smith (1881) recognized *hamillei* correctly in a shell from Usambara. His figure, copied in my Pl. 48, fig. 1, is of nearly average size and shape for this race, 128 mm. long, 70 mm. wide, with the aperture 69 by 37 mm.; the coloration is somewhat unusual, but I have seen very similar shells among Dr. Williams' material. Other writers have occasionally recognized *hamillei* and v. Martens (1897) gave a good figure of a specimen from Tanga. The true relations of *hamillei* to *A. fulica* and its identity with the supposed *A. panthera* with white columella (*A. panthera* var. *leucostyla* Pilsbry) were, however, overlooked.

Original description of *A. letourneuxi* Bourguignat (1879) (French text translated): "Testa valde elongata, parum tumida, sat ponderosa, opaca, nitida, in supremis luteola ac deinde rosacea, in medianis albida, in ultimis luteo-olivacea, ac flammulis rufo-castaneis (supremi exclusi), in ultimo obscure rufo-subolivaceis, ornata; ad apicem laevigata, ad caeteris paulatim striata plicataque et ad ultimum lamellosa (praecipue circa suturam), tandem ad medianos sulcis minutissimis argutissime decussata; spira producta, elongata, acuminata; apice obtusiusculo; anfractibus 9 convexiusculis, sutura (inter inferiores sulcosa) separatis; ultimo oblongo-convexo, relative mediocri, dimidium altitudinis non attingente; apertura fere verticali, ovali, intus albido-margaritacea; margine externo arcuato-convexo; columella arcuata, basi tenuata ac mediocriter truncata; peristomate acuto, intus in margine externo pallide rufo-castaneo; callo albido, sat crasso. Alt. 118 mill.; diam. 50 mill.; alt. apert. 53 mill.; diam. ap. 30 mill. Can only be placed near *A. panthera* [name erroneously used by Bourguignat for *A. fulica hamillei*] for the sum total of its characters, but *letourneuxi* is more slender in all its parts, more elongate, less ventricose, the aperture relatively smaller, less developed; the columella is more elongate, more curved, less robust and more narrowed toward the base (in "*panthera*" the columella, more voluminous, thicker, has in its median portion a slight swelling caused by the torsion of the axis); the spire, more acuminate, more elongate, is markedly more slowly coiled over the upper whorls; finally the body-whorl appears to descend more toward the insertion of the outer margin." The holotype, which I saw at the Paris Museum in 1933, is an elongate *hamillei*, with well-preserved periostracum. It is shown in my Pl. 80, fig. 1. Although such slender shells are more typical of the nominate race of *A. fulica*, some occur

occasionally in populations of subsp. *hamillei* in Zanzibar and on the neighboring mainland.

Original description of *A. panthera* var. *nasimoyensis* Bourguignat (1879) (translated from the French): "A relatively small form, 90 mm. long, 47 mm. wide, with the aperture 50 by 26 mm., differing from the type [supposedly from *panthera*, but actually compared with *fulica hamillei*] only in being proportionately smaller in all parts. The body-whorl seems to be, however, more convex, considering the proportions, and the spire slightly more acute." The holotype was obtained in the locality Nasimoya presumably, together with the type of *A. letourneuxi*, and with specimens of *A. fulica hamillei* (called erroneously *A. panthera* by Bourguignat) of the usual size, 123 mm. long, 62 mm. wide.¹ Similar variation in size and shape is common in any fairly large series of *hamillei* from any given locality and is purely individual. I could not see the actual type at the Paris Museum in 1933, but was shown instead a specimen from Gueledi, Italian Somaliland, labelled in Bourguignat's hand "*Achatina nasimoyensis*" with a manuscript varietal name meaning "larger". This specimen differed in no way from *A. f. hamillei*. Dr. E. Fischer (*in litt.*, 1949) has since found the true type and sent me the photograph shown in my Pl. 79, fig. 2.

Original description of *A. milne-edwardsiana* Révoil (1885): "Testa maxima, oblongo-elongata, solida, ponderosa, opaca, nitida, striatula, ad suturam in medianis rugosa, in ultimo fimbriata aut crispulato-tuberculosa ac prope aperturam lineis duabus spiralibus decussata; — ad superiores uniformiter albido-rosacea, in caeteris albido-vinosa et flammulis latis vinoso-violaceis plus minusve saturatis ornata; — spira elongata, acuminata, ad summum acuta; — anfractibus 10 convexiusculis, regulariter crescentibus, sutura impressa separatis; — ultimo relative mediocri, dimidiam altitudinis non aequante, convexo, circa suturam leviter subcompressiusculo, ad aperturam tumido-rotundato, ad insertionem subito deflexo; — apertura vix obliqua, lunata, subovato-rotundata, externe bene convexa, intus albo-margaritacea; — peristomate recto, obtuso, superne ad insertionem crasso, ad basin leviter acutiusculo; — columella brevi, robusta, contorta valde curvata inferne valide truncata (sinus truncaturae externe sulcum sat productum praebens); marginibus callo crasso alboque junctis." The unfigured holotype from the Uebi Valley was 143 mm. long, 64 mm. wide, with the aperture 60 by 40 mm. The figured paratype, from Usagara, was much larger, 190 mm. long, 94 mm. wide; on the figure the

¹ Mr. A. Loveridge informs me that there is a locality Nasimoya in the Island of Zanzibar, a point about which there appears to have been some doubt. In the "Guide to Zanzibar" (1939 Edition), recently obtained by Dr. F. X. Williams, it appears with the spelling "Mnazi Mnioja" as a suburban section at the southern outskirts of the town of Zanzibar.

aperture is 70 by 55 mm. In the additional French remarks it is stated that the species is "remarkable for its large size, its elongate shape, its relatively small, oval aperture, very rounded outwardly, and its short, very curved, twisted and strongly truncate columella." I have not seen this paratype, the figure of which is copied in my Pl. 40, fig. 3, slightly reduced. It is the largest specimen on record, not only for subsp. *hamillei*, but for the species *fulica* as a whole. It seems to show a slit along the outer or left margin of the columella; this is not, as might be supposed, a true columellar slit, but an adventitious groove produced in old age by the unusual thickening of the columella. I have observed it also in some old *hamillei* sent from the coast of Kenya Colony by Dr. F. X. Williams. Dr. E. Fischer sent me a photograph (my Pl. 78, fig. 3) of a shell labelled *A. milne-edwardsiana* at the Paris Museum, where I saw it in 1933. Although from the type locality, Guedi, it could not well be the holotype mentioned by Révoil, as it is only 118 mm. long. The columella of this shell is white, a point not mentioned in the original description, although the parietal wall is said to be of that color. Connolly (1928) concluded that *milne-edwardsiana* was based on unusually large *A. fulica*. Like *A. letourneuxi* it covers in my opinion elongate individuals of the subsp. *hamillei*.

Original description of *A. panthera* var. *neumannii* v. Martens (1897) (translated from the German): "In general with the characters of *A. panthera*, but the aperture is pure white and strikingly thickened, the outer margin almost a little bent outwardly and inside with a lip-like, somewhat uneven, but not sharply set off swelling; the margin of the columella strongly curved above, then straight, and also very thick, as is also the callus on the parietal wall. Length 126, width 62, aperture 64 mm. Probably a local form, remaining small, although very old." v. Martens' original figure is reproduced in my Pl. 15, fig. 2. I have examined the holotype and only known specimen at the Berlin Museum in 1933. It is an unusually heavy *A. fulica hamillei*, with abnormally thickened outer lip and columella, which accounts for the truncation being obsolete. Dr. F. X. Williams obtained a similar abnormal *hamillei* near Mombasa. That this is not a local Zanzibar form of the species is shown by the large series of *hamillei* collected by Dr. Williams in this Island.

Original description of *A. panthera* var. *leucostyla* Pilsbry (1904): "Shell elongate, rather solid, weakly plicatulate. Last whorl dusky-olive colored with some darker and lighter streaks, violaceous where worn; preceding whorl or two white, boldly striped with dark brown stripes, often interrupted; preceding whorls yellowish-white or pink, narrowly striped with brown. Whorls $8\frac{1}{2}$, the first $2\frac{1}{2}$ smooth and glossy, uniform. Aperture sky-blue within, with a dark purple-brown

border within the acute lip-edge. Columella and parietal callous blue-white. Length 143, diam. 63, aperture 72 mm. Length 107, diam. 50, aperture 56 mm. Length 105, diam. 53, aperture 60 mm. Remarkable for its very dark color, 27 specimens collected agreeing in this. The spire shows the typical *panthera* pattern. It is larger than *A. le-tourneuxi* Bgt., and judging from the description, it is smoother." The author later (1905, p. 216) stated that "This form proves to be so different in genitalia from *A. panthera* that it will stand as a species." I have studied the type material of *leucostyla* at Ac.N.S.Phila. It consists of several specimens of what I regard as the common continental race of *A. fulica*, for which the oldest name appears to be *hamillei* Petit, as shown above. They can be matched with specimens in the long series collected by Dr. F. X. Williams in Zanzibar Id. and near Mombasa. These series also include small, immature shells agreeing with Petit's original figure of *hamillei*. The largest of the cotypes of *leucostyla* (Ac.N.S.Phila. No. 81980), actually 146 mm. long, is shown in Pilsbry's Pl. 40, fig. 3, and in the photograph of my Pl. 47, fig. 1.

The continental East African *A. fulica hamillei* is on the average a larger and bulkier shell than the nominate, insular race of the species, so that if extremes of shape or size are compared, one might be tempted to regard them as two distinct species. The sculpture, color of the columella and type of pattern are, however, the same. It is also possible to select specimens of both races that are practically alike in shape and size. Fullgrown *hamillei* often reach 130 mm. or more in length, the largest individuals having one-half to two whorls more than those of average size. The spire is often much shorter in proportion to the total length than in nominate *fulica*, the body-whorl longer and broader, and the aperture longer, relatively narrower and with a less convex outer lip. All these features are extremely variable, even in the same locality. In small or medium-sized shells the columella is as a rule moderately concave; in some very large, old shells it may be very deeply curved, with the lower end somewhat produced forward. The color and pattern are as variable as in nominate *fulica*. When the periostracum is well-preserved, it is pale olivaceous to golden-yellow; after it wears off, the ground color is white, often with a bluish tinge, particularly on the body-whorl. The chestnut to blackish-brown vertical streaks are as in nominate *fulica*. Usually the terminal two-thirds or half of the body-whorl are almost unstreaked, sometimes with a sharply defined streak corresponding to the black margin of the aperture at an earlier stage of growth. Such a shell is shown in E. A. Smith's (1881) beautiful figure, copied in my Pl. 48, fig. 1. The inner blackish-brown margin of the outer lip is more often present in *hamillei* than in

nominate *fulica*. The nepionic and early post-nepionic whorls are usually white or yellowish-white, as in nominate *fulica*; in a series at all stages of growth, collected by Dr. F. X. Williams in Zanzibar Id., the summit is intensely roseate, down to the sixth whorl and persisting even in adult shells. In all *hamillei* seen the columella and parietal wall are white or bluish-white.

The animal of *A. f. hamillei* was observed in captivity at the M.C.Z., living specimens having been sent by Dr. F. X. Williams from Zanzibar and Mombasa, for dissection. Externally it is much like an enlarged helicid snail. The foot is long and broad and may expand greatly on the sides and extend longitudinally. The upper surface is divided by many coarse and fine impressed lines into an irregular network, the appearance of which changes with the degree of extension. On each side of the upper part of the mouth there is a lobe-like retractile projection. Of the two pairs of retractile tentacles the anterior are the shorter and the posterior can extend much farther and bear the eyes at the tips. The animal is very dark, almost black over the upper surface.

A study of the large series of *Achatina* collected in Zanzibar Id. and the coastal districts of Kenya Colony and Tanganyika Territory, by Dr. F. X. Williams and Mr. A. Loveridge, and some of the types of the named species and varieties discussed above, has led me to the conclusion that all the supposed *A. panthera* with a white columella recorded from this area were specimens of what is here called *A. fulica hamillei*. I have seen as yet no specimens from this area with the characteristic shape and sculpture and the violaceous-red columella of true *A. panthera*. Specimens of *panthera* may be found occasionally in Museums labelled "Zanzibar"; but these are old specimens and their localities are not reliable. In any case, neither Gibbons (1879) nor, more recently, Dr. F. X. Williams found any *panthera* on the Island, although Dr. Williams had been urged to be on the lookout for large *Achatina* with a reddish columella. I also refer to subsp. *hamillei* all the shells from continental East Africa, Zanzibar and the other coastal islets, which previous authors have been calling *fulica*. As stated before, I restrict the name *fulica*, in a subspecific sense, to the shells of the Malagasy Region and the introductions from there to India, the Orient and the Pacific. Moreover, I regard *hamillei* as the ancestral stock of the species, from which the nominate race *fulica* was derived by insular isolation at a comparatively recent date.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Length		
162 mm.	78	77	45	9	Changamwe	
154	73	73	38	8½	Malindi to Shanzu	
153	76	70	37	8½	"	"
147	70	69.5	37	8½	Shanzu	
143	73	72.5	41	8½	Mombasa	
141	80	72	45.5	8	Mkonumbi	
138.5	67.5	70	33	8½	Shanzu	
138	71	73	41	8½	Mombasa	
136	69	71	34.5	8½	Malindi to Shanzu	
135	67	70	38.5	8½	Mombasa	
131.5	70	71.5	38	8½	Changamwe	
130	63	65	35	8	Zanzibar Id.	
129	72	68.5	40.5	8½	Mombasa	
128.5	67	61.5	35	8½	"	
126	65	67	36	8	"	
124.5	63.5	64.5	35	8	"	
121	62	66.5	32	8	"	
116.5	58	59.5	33	7⅔	Zanzibar Id.	
115.5	57	62.5	31.5	7½	Mombasa	
111	61.5	60	35	7½	"	
108.5	57	57.5	30	7½	"	
108	64	60	34.5	7½	"	
107.5	52	56	27	7½	Zanzibar Id.	
105.5	55	59.5	29	7½	"	
101	52	53.5	28	7⅔	"	
98	55.5	58	32	7½	"	
86	45.5	48.5	24.5	7⅓	"	
73	41.5	40	21.5	7	"	

Specimens Examined. KENYA COLONY: Mombasa (J. Bequaert; J. P. Chapin; L. Burgeon; F. X. Williams.—M.C.Z.; Ac.N.S.Phila.; U.S.N.M.; A.M.N.H.; Terv.M.); Wasin Id.,¹ cotypes of *leucostyla* (C.Eliot.—Ac.N.S.Phila.); Malindi (F. X. Williams.—U.S.N.M.; M.C.Z.); Changamwe near Mombasa (U.S.N.M.; M.C.Z.); Witu (A. Loveridge.—M.C.Z.); Mkonumbi near Witu (A. Loveridge.—M.C.Z.); Lamu Id. (A. Loveridge.—U.S.N.M.); Malindi to Shanzu (F. X. Williams.—U.S.N.M.; M.C.Z.); Kilindini (A. Loveridge.—M.C.Z.); Shimba Hills, 15 to 20 miles N. of Mombasa (U.S.N.M.; Terv.M.). — TANGANYIKA TERRITORY: Kitaya, Ruvuma River (A. Loveridge.—M.C.Z.); Tanga (J. Sandground; F. X. Williams.—Berl.M.; U.S.N.M.;

¹ The only map on which I have found Wasin Id. places it close to the coast near Vanga (or Wanga) and Shimoni, and apparently as a dependency of Kenya Colony.

M.C.Z.); Siga Caves near Tanga (A. Loveridge.-M.C.Z.); Amboni Estate near Tanga (A. Loveridge.-M.C.Z.); Magrotto near Tanga (A. Loveridge.-M.C.Z.); Mikindani (A. Loveridge.-M.C.Z.); Masai Steppe (Berl.M.); Bagamoyo (Berl.M.); Dar-es-Salaam (J. Bequaert; A. Loveridge.-M.C.Z.; Terv.M.). — ZANZIBAR ID.: (F. X. Williams; E. L. Petersen.-U.S.N.M.; M.C.Z.; Brus.M.); Mojoní (Berl.M.); Chwaka Bay (F. X. Williams.-U.S.N.M.; M.C.Z.). — PEMBA ID.: (A. Voeltzkow.-Berl.M.). — PORTUGUESE EAST AFRICA: Angoxe (M.C.Z.).

The southernmost locality known for *A. f. hamillei* is Chemba, on the Zambesi River (about 17° S.), and the northernmost, the mouth of the Omo River into Lake Rudolf (about 5° N.).

The average length of available specimens of *A. f. hamillei* is about 124 mm. and the average width about 64 mm. So far as I can find, only one recorded specimen exceeds in length the largest one I have seen (162 mm.). This is the paratype of Révoil's *milne-edwardsiana*, which reached 190 mm. in length. The holotype of this species was, however, not unusually large, being only 143 mm. long. Mr. G. W. Jeffery recently wrote to Dr. F. X. Williams that he obtained at Kilifi (between Mombasa and Malindi) a specimen over 7 inches (178 mm.) long and 3 inches (76 mm.) wide.

e. *A. FULICA RODATZI* Dunker

Pl. 3, fig. 3; Pl. 11, fig. 4; Pl. 30, fig. 1; Pl. 44,
fig. 2; Pl. 52, fig. 1; Pl. 53, figs. 2-3; Pl. 54, fig. 1

Achatina rodatzii Dunker, 1852, *Zeitschr. f. Malakoz.*, **9**, p. 127 (Id. of Zanzibar). Pfeiffer, 1853, *Monogr. Helic. Viv.*, **3**, p. 483. H. and A. Adams, 1855, *Gen. Rec. Moll.*, **2**, p. 132. Dunker, 1857, in Pfeiffer, *Novit. Conchol.*, **1**, p. 97; Pl. 27 (2 views of type). Pfeiffer, 1859, *Monogr. Helic. Viv.*, **4**, p. 601; 1868, *Op. cit.*, **6**, p. 212. Haines, 1868, *Cat. Terr. Shells Coll.*, p. 68. Pfeiffer, 1876, *Monogr. Helic. Viv.*, **8**, p. 273. Gibbons, 1879, *Jl. of Conch.*, **2**, p. 143 (Id. of Zanzibar). Pfeiffer, 1889, *Jahrb. Hamburg. Wiss. Anst.*, **6**, pt. 2, p. 24 (Tanganyika Territory: between Kikoka and Rosako in Usaramo; Msere on Wami River). Paetel, 1889, *Cat. Conch.-Samml.*, 4th Ed., **2**, p. 240. Bourguignat, 1889, *Moll. Afr. Equat.*, p. 76. v. Martens, 1897, *Deutsch-Ost-Afrika*, **4**, Beschalte Weichth., p. 85 (Tanganyika Territory: a young presumably of this form from Usambara); 1897, *Arch. f. Naturgesch.*, **63**, pt. 1, p. 54; 1897, *Mitt. Naturh. Mus. Hamburg*, **14**, p. 114 (1901, *Zool. Ergebn. Küstengebiete Ost-Afrika Reise Stuhlmann*, **2**, pt. 15, p. 4).¹ Pilsbry, 1904, *Man. of Conch.*, (2), **17**, p. 60;

¹ The shell from Bagamoyo (F. Stuhlmann), referred by v. Martens to *A. rodatzii*, was seen at the Hamburg Museum. I regard it as belonging to *A. bloyeti* Bourguignat, the sculpture being much too strong, particularly on the body-whorl, for *rodatzii*.

Pl. 45, fig. 3 (after Dunker). Germain, 1905, Bull. Mus. Hist. Nat. Paris, **11**, p. 255 (eastern part of Tanganyika Territory); 1908, Rés. Scientif. Voy. Afrique Foà, p. 631. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66.

Achatina (Achatinus) rodatzii Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265.

Achatina chrysouleuca Pilsbry, 1897 (November 23), Proc. Ac. Nat. Sci. Philadelphia, **49**, p. 357 (Southern Abyssinia: Tulu Didirko, about 4° 4' N., 39° 36' E., at 3,580 ft., E. of Lake Stefanie); 1904, Man. of Conch., (2), **17**, p. 59 (also Anglo-Egyptian Sudan: Magois, about 5° 30' N., 35° E., an immature shell); Pl. 16, fig. 13 (holotype); 1905, *Op. cit.*, (2), **17**, p. ix, fig. 6 (radula), and pp. xii-xiii (anatomy), of Introduction; Pl. 64, figs. 64 and 68 (anatomy). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65.

Achatina erlangeri v. Möllendorff and Kobelt, 1902, Nachrichtsbl. D. Mal. Ges., **34**, p. 180 (Italian Somaliland: Wabbi [Uebi or Webbi] Valley; Ganale Valley). Pilsbry, 1904, Man. of Conch., (2), **17**, p. 59. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, pp. 18 and 65; Pl. 2, fig. 1 (paratype); Pl. 3, fig. 1 (holotype). Connolly, 1928, Atti Soc. Nat. Mat. Modena, (6), **7**, (or vol. **59**), p. 127 (Italian Somaliland: between El Sai and Torda); 1928, Proc. Zool. Soc. London, p. 180. Haas, 1932, Senckenbergiana, **14**, p. 176 (figured holotype, paratype figured by Kobelt, Pl. 2, fig. 1, and four other paratypes, all from Ganale Valley, at Senckenberg Museum).

Achatina daroliensis Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, pp. 19 and 65 (Southern Abyssinia: Daroli); Pl. 11, figs. 1-2 (2 views of holotype) Connolly, 1928, Atti Soc. Nat. Mat. Modena, (6), **7**, (or vol. **59**), p. 12 (Italian Somaliland: Genale; Baidoa; Bardera); 1928, Proc. Zool. Soc. London, p. 180. Haas, 1932, Senckenbergiana, **14**, p. 176 (holotype at Senckenberg Museum). Bacci, 1941, Ann. Mus. Civ. Genova, **41**, p. 133 (Italian Somaliland: Baidoa).

Original description of *A. rodatzii* Dunker (1852): "A. testa elongata ovato-conica, apice acuta, crassiuscula, tota alba, epidermide pallide olivacea vestita; anfractibus $8\frac{1}{2}$ parum convexis, sutura haud profunda vix crenulata divisis, ad longitudinem obsolete plicatis, superioribus transversim decussatis subreticulatis et granosis, ultimo dorso $\frac{3}{5}$ totius longitudinis testae aequante; apertura ovali superne acuta; columella parum arcuata, basi oblique truncata; peristomate acuto. Long. fere 5'' [=131mm.], latit. max. 2'' 3''' [=59 mm.], long. apert. 2'' 7''' [=67.5 mm.], latit. ejusdem 1'' 3''' [=33 mm.]. Species haec magna unicolor alba statu integro epidermide pallide olivacea induta, habitu maxime accedit ad *Achatinam acutam* Fér., a qua tamen praesertim differt anfractibus minus convexis, sutura vix crenulata, columella parum arcuata, flammis strigisque omnino deficientibus. *Achatina lactea* Reeve testa solida multo minore, sculptura

in anfractu ultimo granulato-decussata, ratione anfractuum et aperturae forma facile distingui potest." Dunker had originally two specimens, both in his collection; but their present whereabouts is unknown. In 1857 he repeated the original description (with a German translation), making a few changes: the spire was now called "sub-acuta," the aperture "lactea", and the description of the outer lip was omitted. He also remarked that the color of the periostracum was somewhat too bright in the 2 figures of his Pl. 27, which are copied in my Pl. 30, fig. 1, and Pl. 54, fig. 1, two views of one shell. As these figures are exactly of the length given in the original description, they may be taken to represent the holotype. It should be noted that the lighter and darker blotches of my copies are merely areas where the periostracum was only partly preserved and do not correspond to markings. Likewise the transverse lines on the body-whorl are not due to sculpture, but are slightly darker yellow lines of the periostracum. I have observed a similar spiral zonation or striping of lighter and darker yellow in some of the *rodlatzi* found by Dr. F. X. Williams in Zanzibar Id.

Original description of *A. chrysoleuca* Pilsbry (1897): "Shell ovate, with conic spire, in general contour like *A. variegata* [*A. achatina* Linné]. Solid and strong, though not very thick. White, with a thin golden-brown cuticle, which is deciduous over the greater part of the shell, remaining behind the aperture and in the depressions between longitudinal plications elsewhere; later $1\frac{1}{2}$ whorls immaculate, the next earlier with spaced, somewhat zig-zag and rather broad brown streaks, the next earlier narrowly streaked, the streaks straight. Whorls of the spire soiled white. Whorls $6\frac{1}{2}$ (the apical whorls truncated, perhaps 1 or $1\frac{1}{2}$ whorls being thereby lost), moderately convex, the last quite convex. Surface shining, finely decussated on the spire, the sculpture hardly visible to the naked eye, and gradually becoming obsolete, the spirals lost on the latter $1\frac{1}{2}$ whorls, which are somewhat coarsely plicatulate. Sutures even above, weakly and irregularly serrate below. Aperture a little exceeding half the length of the shell, pure white within, subvertical, acuminate above, deeply excised by the body-wall; outer lip rather regularly arcuate, but less curved above, simple; columella short, cylindric, very deeply concave on the front and the side toward aperture, abruptly truncated at base, delicate flesh-tinted; parietal wall with a thin, transparent varnish. Alt. 105, diam. 58 mm. Longest axis of aperture 60, greatest width of cavity 33 mm. It is an ivory-white shell, with some inconspicuous marking on the spire. The cuticle is largely deciduous." The author's later description (1904) has a few changes, the most important of which are: the shell is said to be moderately solid and is now compared with *A.*

hamillei and *A. petersi*; the finely decussate sculpture is restricted to the antepenultimate whorl; the outer lip is thin and acute. The following remarks are added: "There is a little prominence at the periphery, and there are some oblique flattened places above it on the last whorl. The columella is very short and sinuous. *A. petersi* is a thinner shell than *chryssoleuca*, differently colored, with finer vertical sculpture and far more spiral grooving on the last whorl." It is also stated that the type specimen was collected alive. I have examined Pilsbry's holotype (Ac.N.S.Phila. No. 68113), shown in my Pl. 44, fig. 2. It appears to be an extremely obese and relatively short specimen of the almost unicolorous race of *A. fulica*, covered with a golden-yellow periostracum, described by Dunker as *A. rodatzii*. The series of *rodatzii* collected by Dr. F. X. Williams on Zanzibar Id. bridge the gap between the slender type of Dunker and the obese type of Pilsbry's *chryssoleuca*. These unicolorous shells show occasionally traces of darker, yellowish-brown vertical streaks, particularly on the earlier whorls, as described by Pilsbry. v. Martens (1897) notes their presence in a young *rodatzii* from Usambara, and furthermore that one of Dunker's original figures of the type shows traces of them. Both Gibbons (1879) and Dr. F. X. Williams found *rodatzii* in Zanzibar in the same colonies with normally marked *A. fulica hamillei*, though in smaller numbers; and Gibbons suspected that the two were very closely related.

Original description of *A. erlangeri* v. Möllendorff and Kobelt (1902): "T. imperforata, conoideo-ventricosoblonga, solidissima, ponderosa, indistincte plicato-striatula, fere laevigata, nitidula, alba. Spira fere exacte conica apice acutula, glabro, hyalino. Anfr. $7\frac{1}{2}$ convexiusculi, ultimus magnus, spiram multo superans, bene convexus. Apertura fere verticalis, subauriformis, basi subeffusa; peristoma rectum, obtusum, columella, sat torta, basi oblique valde truncata. Diam. 68, alt. 122.5, apert. lat. 41, long. 65.5, alt. 60 mm." In 1910 Kobelt added the following description (translated from the German): "Shell completely imperforate, large and heavy, elongate conical, somewhat ventricose, indistinctly plicately striate, looking almost smooth, fairly shiny, unicolorous white; no traces of periostracum or markings in any of the numerous specimens seen. Spire almost exactly conical; apex rather pointed, smooth, strongly shiny. $7\frac{1}{2}$ somewhat convex whorls, the body-whorl large, much longer than the spire, distinctly convex. Aperture almost vertical, nearly ear-shaped, compressed and somewhat gutter-shaped at the base; outer lip straight, obtuse; columella distinctly twisted, strongly truncate at the base." I made a careful study of the type series of *erlangeri* at the Senckenberg Museum in 1933. The holotype (No. 4852), labeled "Ganale-Tal",

is an unusually heavy shell, collected dead and weathered. It had been broken in life and repaired by the animal, so that it may be somewhat abnormal. It is the original to Kobelt's Pl. 3, fig. 1 (copied in my Pl. 52, fig. 1). Several of the paratypes are also weathered shells; but a few have portions of the pale yellowish periostracum preserved, showing that *erlangeri* belongs to the albino race *rodatzii*. One of these relatively fresh paratypes is now at M.C.Z. (my Pl. 53, fig. 3). I have seen additional paratypes at the Berlin Museum. The sculpture and general shape of all these shells are those of *A. fulica*.

Original description of *A. daroliensis* Kobelt (1910): "Testa imperforata, ovato-acuminata, solida, ? albida spira rufescente, striis in anfractibus superis subtilibus, sulcis spiralibus microscopicis subgranulosis, sculptura spirali evanescente. Spira conica lateribus vix convexiusculis, sutura impressa, inter anfractus inferos irregularis, subtiliter crenulata, obsolete albomarginata. Anfractus $7\frac{1}{2}$ convexiusculi, celeriter accrescentes, apicales laeves, ultimus $\frac{3}{5}$ altitudinis occupans, subventroso-rotundatus. Apertura ovata, fere verticalis, supra acuminata, faucibus albido-rosaceis, marginibus callo tenuissimo vix junctis, externo acuto, tenui, basali sat longe ultra truncaturam columellae contortae producto. Alt. 77, diam. 42, alt. apert. obl. 43 mm." The following additional description is translated from the German: "Shell imperforate, acuminate ovate, not particularly drawn out in length, solid, both available specimens collected dead and white with reddish spire, the upper whorls finely and densely striate and very finely granulate through microscopic spiral lines, the body-whorl with coarse rib-striae and without spiral sculpture below the periphery. Spire conical with scarcely convex sides and a smooth, rather sharply rounded apex. Suture somewhat impressed, irregular between the lower whorls, weakly crenulate, with a very indistinct pale margin. $7\frac{1}{2}$ slightly convex whorls, rapidly increasing, the body-whorl occupying three-fifths of the total length when measured from the back and somewhat roundly swollen. Aperture not very large, ovate, acute above, reddish inside; the insertions of the margins are connected by a glazed layer, which is very thin but distinctly delimited outwardly; the outer lip is thin, sharp, moderately rounded, the basal margin acutely rounded and extended considerably beyond the truncation of the strongly twisted columella. Undoubtedly related to *A. erlangeri*, but differing considerably in the manner of coiling." An examination of the holotype and paratype and a comparison with the type series of *A. erlangeri*, at the Senckenberg Museum, in 1933, showed that *daroliensis* was apparently based on immature shells, collected dead and bleached, of *erlangeri*. Hence *daroliensis* also is here included in the synonymy of *A. fulica rodatzii*. One of the original

figures is copied in my Pl. 3, fig. 3. The reddish color of the spire and of the inside of the aperture, mentioned by Kobelt, is due to staining by foreign material.

The subsp. *rodatzii* agrees in size, shape and sculpture with average specimens of *A. f. hamillei*, and is equally variable in outline. It is little more than the albino race of *hamillei*. Even in fresh and living specimens, some of which were under observation at the M.C.Z., the shell material is pure white, and covered with a thin, deciduous, pale olivaceous-yellow to golden-yellow periostracum, with a few darker yellow or duller vertical streaks or lines, seemingly corresponding to arrests in growth. Some specimens also show a faint zonation or spiral striping of darker and lighter yellow in the periostracum of the body-whorl. The inside of the aperture, including the inner margin of the outer lip, the columella, the thin glazed callus of the parietal wall, and the summit of the spire are milky-white.

Connolly (1928, p. 126) refers to *A. daroliensis* a fresh specimen, from Genale, which he describes as follows (translated from the Italian): "Of 7 whorls and agreeing perfectly in dimensions with Kobelt's type, being scarcely one millimeter smaller in length as well as in width. The color is leather-yellow with reddish flames and spots on the 4th, 5th and 6th whorls, gradually decreasing in number until they disappear on the body-whorl." I have seen similarly colored specimens in our lots of *hamillei* from Zanzibar Id. and the Mombasa area. They are evidently transitional between *A. f. hamillei* and *A. f. rodatzii*. A more interesting connecting specimen is an immature shell from Voi (A. Loveridge), at M.C.Z. It is 88.5 mm. long, 43 mm. wide, of $6\frac{1}{2}$ whorls, with the aperture 41.5 by 23 mm. Except for the white parietal wall and columella, it resembles somewhat Férussac's Pl. 125, figs. 3-4 of *H. zebrina* (= *A. fulica castanea* Lamarck). The shell is white, covered with a golden-yellow periostracum, worn off in places, and with a few narrow, widely spaced, straight or slightly wavy vertical russet-brown streaks (Pl. 55, fig. 3). It was found with normal *rodatzii*.

Specimens Examined. SOUTHERN ABYSSINIA: Tulu Didirko, E. of Lake Stefanie, holotype of *chrysoluca* (A. D. Smith.-Ac.N.S.Phila.); Daroli River, 7° 30' N., 40° 30' to 42° E., holotype and paratype of *daroliensis* (C. v. Erlanger.-Frankf.M.). — ITALIAN SOMALILAND: without precise locality (Brus.M.); Ganale Valley, holotype and paratypes of *erlangeri* (C. v. Erlanger.-Frankf.M.; Berl.M.; M.C.Z.; Brit.M.). — KENYA COLONY: Voi (A. Loveridge.-M.C.Z.); South Creek on Mt. Garguess, 3600 ft. (E. Heller.-U.S.N.M.; M.C.Z.); Camp on Tana River (U.S.N.M.; M.C.Z.); between Mt. Eudoto and Tana River (E. A. Mearns.-U.S.N.M.; M.C.Z.); Shanzu, 8 miles N.

of Mombasa (F. X. Williams.—U.S.N.M.; M.C.Z.). — TANGANYIKA TERRITORY: Madabado Mts. in the Masai Steppe (Glauning.—Berl.M.; M.C.Z.); Ruaha (Prittwitz and Gaffron.—Berl.M.). — ZANZIBAR ID.: (J. S. Gibbons; F. X. Williams.—M.C.Z.; U.S.N.M.; Brus.M.; A.M.-N.H.); Chwaka Bay (F. X. Williams.—M.C.Z.).

Although often found in the same localities or even in the same colonies with *A. f. hamillei*, from which it is evidently derived, the albino race *rodatzii* appears to be most frequent in the drier or semi-desertic portions of the general area covered by the species. It reaches farther north ($7^{\circ} 30' N.$) on the African continent than any of the other forms of *A. fulica*.

The M.C.Z. has an abnormal *A. f. rodatzii*, from "East Africa", very broadly and deeply umbilicate (Pl. 53, fig. 2). It is 118 mm. long, 68 mm. wide, of nearly 8 whorls, with the aperture 60 by 34 mm. It shows traces of injury in two areas of the penultimate whorl, which may explain the deformity.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Length		
148 mm.	70	70	36	8		Shanzu
142	66	70.5	35	8		"
134	66.5	61	36	8		Tana River
130	67	70.5	37	8		Zanzibar Id.
120	62.5	66	33	$7\frac{2}{3}$		Shanzu
117	62	69	31	$7\frac{1}{2}$		Zanzibar Id.
113	61	62	33	$7\frac{1}{2}$		"
110	54	56.5	30	$7\frac{1}{2}$		"
109	58	60	31	$7\frac{1}{2}$		Ganale; paratype of <i>erlangeri</i>
106	53	59	30	$7\frac{1}{3}$		Zanzibar Id.
98	50	54	28	7		"

Some of the larger specimens in this table agree well with Dunker's type of *rodatzii* in size and proportions; while others, among the smaller ones, come closer to Pilsbry's *chrysoleuca*.

ACHATINA (LISSACHATINA) LACTEA Reeve

Pl. 24, fig. 3; Pl. 48, fig. 2

Achatina lactea Reeve, 1842 (November), Proc. Zool. Soc. London, (for 1842), p. 55 ("Zanzibar"); 1842 (month ?), Conch. System., 2, p. 86; Pl. 177, fig. 6 (type). Catlow and Reeve, Conchologist's Nomenclator, p. 165.

- Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 252. Reeve, 1849, Conch. Icon., **5**, *Achatina*, Pl. 12, fig. 4 (type). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 487. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 603; 1868, *Op. cit.*, **6**, p. 217; 1876, *Op. cit.*, **8**, p. 275. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240. v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 82; 1897, Arch. f. Naturgesch., **63**, pt. 1, p. 54. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 35; Pl. 16, fig. 12 (after Reeve, 1842). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. Connolly, 1928, Atti Soc. Nat. Mat. Modena, (6), **7**, (or vol. **59**), p. 126 (Italian Somaliland: Garbauen in Obbia District; between El Sai and Torda; between Gumbo and Bieja; Uardavèl in the drainage of the Uebi Scebeli; Bur Budulca; Bur Cal-ic-Corar; Tiglieló). Cox, 1930, Monogr. Geol. Dept. Hunterian Mus., Glasgow Univ., **4**, p. 149 (Kenya Colony: post-Pliocene fossil in raised reef S. E. of Mombasa Id., about $\frac{1}{4}$ mile N. of Ras Serani). Nardini, 1933, Paleontographia Italica, **32**, Suppl. 1, p. 179 (Italian Somaliland: Pleistocene fossils; plain of Gumbo; Amarr Gegeb near Mogadischu; Bohal Dablarrez in Obbia District; caves near Mogadischu, on road to Afgoi; hospital of Mogadischu); Pl. 22 (or 17), figs. 2 (adult) and 3a-b (2 views of immature). Bacci, 1939, Ann. Mus. Civ. Genova, **58**, p. 337, fig. 2 (anatomy. Italian Somaliland: Afgoi, W. of Mogadischu); 1941, *Op. cit.*, **61**, p. 132 (Italian Somaliland: 50 Kilom. inland from Itala; between Bugda Acable and El Dubbo; Buloburti). Coen, 1945, Catalogo Gasteropodi Polmonati Coll. Coen, p. 42.
- Achatina (Achatinus) lactea* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265.
- Achatina marioni* Ancy, 1881, Le Naturaliste, (1), **3**, p. 414 (Kenya Colony: "Elai Country in the interior of Zanguebar, at a higher latitude than Zanzibar"); 1885, Bull. Soc. Mal. France, **2**, p. 140 (locality here said to be "Elai Country, between Brava and Lake Victoria"; the type lot comprised several specimens, all found dead). Bourguignat, 1889, Moll. Afr. Equat., p. 74. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 39. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65. Fulton, 1922, Proc. Mal. Soc. London, **15**, pt. 1, p. 26. Not *Achatina marioni* Matheron, 1868.
- Achatina fulica* var. *solida* de Angelis, 1900, in de Angelis and Millosevich, Sec. Sped. Bottego, Studio Geolog., (Rome), p. 147 (Italian Somaliland: hill near Brava); Pl. 3, fig. 7.
- Achatina fulica* var. *poudrosa* "de Angelis" Connolly, 1928, Atti Soc. Nat. Mat. Modena, (6), **7**, (or vol. **59**), p. 150 (error for var. *solida* de Angelis).
- Achatina fulica* Piersanti, 1941, Missione Biologica Sagan-Omo, **12**, (Zoologia, 6), p. 271; Pl., fig. 26 (Southern Abyssinia: mouth of Omo River in Lake Rudolf). Not of Bowdich, 1822.
- [*Achatina lactea elongata* Coen, 1945, Catalogo Gasteropodi Polmonati Coll. Coen, p. 42 (without description. Italian Somaliland: subfossil at Mogadischu). *Nomen nudum*].

Original description of *A. lactea* Reeve (1842): "Ach. testa oblongo-ovata, solida, intus extusque quasi fossili, lactea, epidermide levidensi sparsim induta; spira regulari, anfractibus longitudinaliter striatis, lineisque minutis circumdatis; apertura suboblonga, labro solidiusculo. Long. $4\frac{1}{10}$; lat. $2\frac{1}{10}$ poll. [105.5 and 53 mm.]. This beautiful shell, which is in a perfectly live state, and covered with a slight scattered epidermis, is of a rich uniform cream-color, without the least indication of any pattern; the whorls are very fully striated longitudinally, the striae rather irregularly following the growth of the shell; and they are again characterized by having a number of fine lines running around the upper half of them in an opposite direction. The columella, the aperture, indeed the entire shell, both inside and out, is of rich cream-color, and by this alone it cannot fail to be recognised." As Reeve cites with this original description Pl. 177, fig. 6, of his Conch. System., published without a description but with the name, it is possible that this Plate may have appeared first. This first figure, copied in my Pl. 48, fig. 2, is 102 mm. long, 55 mm. wide, with the aperture 56 by 28 mm. and the earliest whorls broken off. The second figure of the type (1849), although clearly drawn from the same shell, is slightly larger, 105 mm. long, 53 mm. wide, with the aperture 58 by 28 mm.; it is also not as yellowish as the first figure, at least in the copy seen. I saw the type at the British Museum in 1933 and it agrees in every respect with the two figures.

Original description of *A. marioni* Ancey (1881); "Long. 113; lat. 66 mill. Ovato-elongata, crassa, solida, omnino lutescente-albida, nitens, pergranulata ($2\frac{1}{2}$ primis anfr. exceptis). Spira apice obtusa, anfr. 8, rapide crescentibus, convexis, ultimo coeteris majore, rotundato; omnibus, primis exceptis, strigis irregularibus spirialibus et longitudinalibus, in parte supera praesertim anfractuum impressis, granigeris et decussatis. Apertura simplice, ovali, truncata, non expansa aut reflexa; marginibus callo micante crassissimo junctis. Parte interiore pallide lutea." The following additional remarks are translated from the French: "It is close to *A. reticulata* Pf., of Guinea, but differs in the fewer whorls, the color, the smaller size, the much finer granulation, and the lack of rugosities on these granulations. The shell is also less elongate." In 1885 Ancey added a few notes, based on the type series (translated from the French): "Like *A. reticulata*, which it resembles somewhat, although it is colorless, much shorter, more strongly conical and much smaller, *A. marioni* is provided with coarse granulations on the last three whorls; these granulations are produced by longitudinal striae being cut by horizontal striae, rather indistinct. This sculpture stops at the lower part of the penultimate whorl, near the suture, or at least becomes very weak. It changes also

below the middle of the body-whorl to another similar but much finer sculpture, the granulations becoming then much less marked. This transformation is rather abrupt. The penultimate whorl of *A. marioni* tends to be rather strongly swollen. The shell material is calcareous and quite thick. The truncation of the columella is strong and oblique." *A. marioni* seems to have been overlooked by v. Martens when he wrote his account of the Mollusks of East Africa (1897). Ancey stated at first (1881) that the type was at the Marseilles Museum of Natural History. I have not seen this shell. In his later account (1885), however, he mentioned that the original lot comprised several specimens, all found dead. Some of these were evidently retained in his collection and later found their way elsewhere, probably after his death through G  ret. I saw one of these paratypes in the Putzeys Collection, in 1933, and it is now at the Tervuren Museum. I recognized at the time that it agreed in every respect with *A. lactea*, although Ancey's measurements exceed somewhat those of Reeve's type. There is, therefore, no need to coin a new name for the homonym which Ancey had inadvertently introduced.

A. fulica var. *solida* was very briefly defined by de Angelis (1900) as being similar to v. Martens Pl. 2, fig. 1 (representing *A. fulica*), in v.d. Decken's "Reisen in Ost-Afrika" (1868), but very thick and with a peculiar sculpture. Length, 115 mm.; width, 50 mm.; aperture, 50 by 31 mm. The shell is readily recognized from d'Angelis' figure as *A. lactea*, with which species Connolly (1928) synonymized it. The present location of the type is unknown. Piersanti's (1941) figure of a supposed *A. fulica* from the mouth of the Omo River, likewise shows the characteristic sculpture of *A. lactea*; this shell was 110 mm. long, 58 mm. wide, of 8 whorls, with the aperture 50 by 30 mm.

A. lactea is here discussed because it is likely to be confused with *A. fulica*, particularly the unicolorous race, *A. f. rodatzki*, although it is very distinct owing to the coarse, bead-like sculpture of body-whorl and penultimate whorl. It is a moderately large, thick and heavy shell, 90 to 120 mm. long, regularly acuminate-ovate, in outline somewhat intermediate between *A. fulica* and *A. panthera*. The whorls, particularly the last, are more convex than in *panthera*; but the subsutural upper portion of the body-whorl is somewhat flattened as in that species. Early whorls somewhat drawn out, smooth; later whorls with regular spiral rows of granulations, either bead-like or slightly lengthened vertically. The sculpture is particularly coarse on the upper third of the body-whorl some distance above the periphery, being well visible to the naked eye. At and below the periphery the granulations are superficial and irregular, although traces are present even near the base and at the columella. All specimens I have seen, some of

them evidently collected alive, were pure white or slightly stained yellowish (probably through the lateritic soil), but completely deprived of periostracum.

Specimens Examined. ITALIAN SOMALILAND: Benadir District, 2 specimens (Ac.N.S.Phila.); Elai Country, in the hinterland of Brava, paratype of *A. marioni* (Terv.M.). — ZANZIBAR ID.: holotype of *laetea* (Brit.M.); several additional specimens, apparently distributed by Cuming (Copenh.M.; M.C.Z.; Berl.M.).

Although several examples (including Reeve's type) are labelled "Zanzibar" in collections, there is no certainty that *A. laetea* lives now or ever lived on that island. It is reliably known only from the coastal area of Northeast Africa, from southern Somaliland to Mombasa, a section formerly included in what was called "Zanguebar," and at one time part of the domain of the Sultan of Zanzibar. The Mombasa record by Cox (1930) is based only on Post-Pliocene fossils which could stand more careful study. Piersanti's specimen, from the mouth of the Omo River, would extend the area of the species to 600 miles from the Coast. This might indicate that the Elai Country (not found thus far on any of my maps), the type locality of Ancey's *A. marioni*, may have been a considerable distance inland.

Measurements of Adult Shell

Length	Greatest Width	Aperture		Whorls	
		Length	Width		
97 mm.	52	51.5	28	7 $\frac{1}{4}$	Zanzibar (?)

ACHATINA (LISSACHATINA) PANTHERA (Férussac)

When full-grown, the shell of *A. panthera* has 8 to 9 whorls and is large, capacious and fairly heavy, often reaching over 140 mm. in length and 80 mm. in greatest width. It is regularly acuminate-ovate, with a broadly conical and relatively short spire, the summit not particularly drawn out. It varies relatively little, small specimens having about the same outline as large ones. More slender individuals are exceptional. The whorls of the spire are moderately convex, the sutures being narrow and slightly depressed. The body-whorl is very large, two-thirds or more of the total length of the shell, somewhat saccate toward the base, very gradually narrowed toward the spire and flattened at the suture, particularly over the terminal third. The aperture is elongate-ovate, very long, usually over half the total length of the shell and longer than the spire. The outer lip is sharp, thin or slightly thickened, frequently somewhat expanded, sometimes mark-

edly so in old shells; it is moderately convex, more curved below than above, being decidedly flattened where it joins the body-whorl at a narrow sharp angle. The columella is long, weakly concave to nearly straight. The sculpture, much coarser than that of *A. fulica*, furnishes in my opinion one of the most reliable specific characters. The nepionic whorls are smooth in all specimens seen; but I have not examined newly hatched or very young shells. On the earliest post-nepionic whorls the vertical growth-striae are fine and cut by very fine, irregularly spaced, engraved spiral lines. Beginning with the fourth whorl, the decussation gradually grows stronger, producing vertically elongate welts on the much heavier growth-striae. On the body-whorl the vertical striae change to strong, close-set low ridges, extending fairly regularly from the suture to the base, producing a coarsely plicatulate surface, very different from the nearly even body-whorl of *A. fulica*. The decussation continues, though weaker, over the upper half of the body-whorl, but fades away behind the outer lip; there are also slight traces of it in the lower half, below the periphery. Toward the sutures the growth-striae become even coarser, also on the penultimate whorl, producing strong subsutural folds; the suture itself is irregular and superficially crenulate.

The color and pattern appear to be fairly uniform, more so than in *A. fulica*. The periostracum is rarely preserved in adult shells. The earliest 3 to $3\frac{1}{2}$ whorls are unicolorous white. The ground color of the remainder of the shell is yellowish or bluish-white to buff. On the latter part of the third whorl faint, spaced, vertical, light brown streaks appear; these become broader and bolder, mahogany to chestnut-brown, from the sixth whorl on, sometimes russet with a purplish tinge; they are often irregular or jagged at the edges, sometimes zig-zag-like or broken up into confluent patches; in addition the pale areas of the body-whorl often show small brownish blotches or spots. In all boldly marked, normal specimens which I refer to *panthera* on the strength of the general shape, outline of body-whorl and aperture, and coarse sculpture, the columella and the callus of the parietal wall are vinaceous-pink; in most large adult shells the outer lip also has a broad rose-colored inner edge. The pink color may, of course, fade and eventually disappear in dead, bleached shells; but often some suggestion of it remains. I have as yet seen no true *fulica* (or any of its races) with a pink columella, although I readily admit that such specimens are not an impossibility. On the other hand, with the exception of the depauperate albino form *aniourtoutensis*, of Madagascar, no fresh true *panthera* were observed with a white columella. The so-called *panthera* with a white columella, which I have studied in various collections, had the shape and sculpture of *fulica* and were

usually *A. fulica hamillei*. I have referred to the latter race nearly all published records of such specimens, as they were mostly based on shells from continental East Africa or Zanzibar.

Because of the frequent confusion with *A. fulica*, the exact area inhabited at present by *A. panthera* is as yet difficult to determine. It is further complicated by the fact that the specific limits between *A. panthera*, *A. layardi* Pfeiffer and *A. immaculata* Lamarek are at present ill-defined. All true *panthera* I have seen thus far came from Madagascar, Mauritius, southern Nyasaland, and Portuguese East Africa. There are also reliable records from Réunion, the Seychelles, the Comoros and the eastern border sections of Southern Rhodesia and of Transvaal. Connolly (1939) discounts rightly the supposed occurrence of this species at Port Elizabeth. The continental area would seem to extend along the East Coast from the Island of Mozambique (15° S.) to Lourenço Marques (Rikata, 25° 45' S.) and to stretch inland some 150 to 200 miles. Most old collections have specimens of true *panthera* labelled "Zanzibar"; but I regard this as an erroneous locality. Neither J. S. Gibbons (1879) nor Dr. F. X. Williams (1948) saw any true *panthera* in that island. As I have indicated in the discussion of *A. fulica*, I do not regard *A. panthera* as truly indigenous in the islands of the Malagasy Region where it now occurs. I believe it was introduced by man into Madagascar at a comparatively recent date, notwithstanding Newton's (1895) record of supposedly Pleistocene fossil specimens from that island. According to Benson (1858) it was brought from Madagascar to Mauritius in 1847. The earliest record from Réunion is by Deshayes (1863), from the Comoros by Haines (1848) and from the Seychelles by Dautzenberg (1893). It is remarkable that the species never spread beyond this area, as did its companion, *A. fulica*.

So far as my material goes, *A. panthera* appears to be much less variable than *A. fulica*. I have retained Pfeiffer's *lamarckiana* as subspecifically distinct, mainly in order to call attention to the synonymy of the name. It should be noted, however, that both *Achatina immaculata* Lamarek (1822) and *Achatina layardi* Pfeiffer (1858) may eventually prove to be only subspecifically separable from *A. panthera* (Férussac, 1832). If this were true, the species as a whole would have to be called *A. immaculata*, Lamarek's name being the oldest of the three. I do not have at present the material nor the time to go into this problem. The peculiar shell described by Crosse as *A. antourouensis*, I regard as the dwarf albino subspecies of *panthera*.

a. Typical A. PANTHERA

Pl. 5, fig. 3; Pl. 34, fig. 1; Pl. 38, fig. 2;

Pl. 56, fig. 2; Pl. 57, fig. 1; Pl. 58, fig. 3

- Helix (Cochlitoma) panthera* Férussac [1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 49 (or p. 53) (no locality; without description or reference; *nomen nudum*); 1832 (?August 4), Hist. Nat. Moll. Terr. Fluv., Atlas, Pl. 126, figs. 1-2 (Plate with name engraved, published by Férussac in Livr. 28)].
- Achatina panthera* Deshayes, 1838, in Lamarck, Hist. Nat. Anim. Sans Vert., 2d Ed., **8**, p. 309. Pfeiffer, 1841, Symbolae Hist. Helic., **1**, p. 23. Deshayes, 1844, in Lamarck, Hist. Nat. Anim. Sans Vert., 3d Ed., **3**, p. 379. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 165. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 252. Reeve, 1849, Conch. Icon., **5**, *Achatina*, Pl. 3, fig. 12 (Madagascar). Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 159, and Expl. of Plates, p. 18. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 487. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, pp. 131 and 132; Pl. 73, fig. 3 (specimen with animal). Benson, 1858, Jl. de Conchyl., **7**, p. 267 (said to have been introduced in Mauritius from Madagascar in 1847). Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 603; 1860, Syst. Conch.-Cab., **1**, Abt. 13, pt. 1, p. 327; Pl. 28, fig. 1. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 201; 1860, Malak. Blätt., **6**, p. 214 (Portuguese East Africa: Mozambique District). Morelet, 1860, Séries Conchyl., **2**, p. 69 (Madagascar: Port Léven on N. E. coast, 12 leagues S. of Cape Amber). Deshayes, 1863, in Maillard, Notes Ile Réunion, 2d Ed., **2**, Annex E, p. 90 (Réunion). Bielz, 1865, Verzeichn. Moll. Conch.-Samml., 3d Ed., p. 23. Dohrn, 1865, Proc. Zool. Soc. London, p. 232 (Portuguese East Africa: Mozambique; Zambesi River). Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 217. Haines, 1863, Cat. Terr. Shells Coll., p. 63 (Comoros). Paetel, 1869, Moll. Syst. Cat., p. 80. G. Nevill, 1870, Jl. Asiatic Soc. Bengal, **39**, pt. 4, p. 414. Paetel, 1873, Cat. Conch.-Samml., p. 99. Fridrici, 1874, Bull. Soc. Hist. Nat. Metz, **13**, p. 184. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 275. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 54. Liénard, 1877, Cat. Faune Mal. Maurice, p. 54. Clessin, 1878, Jahrb. D. Mal. Ges., **5**, pp. 179, 181, and 183. Morelet, 1878, Jl. de Conchyl., **26**, p. 171 (according to Dupont introduced some 20 years ago and now supplanting *A. fulica* in Mauritius). Gibbons, 1879, Jl. of Conch., **2**, p. 143 (Portuguese East Africa: Mozambique Id.; Inhambane. Epiphragm; egg). v. Martens, 1879, Monatsber. Ak. Wiss. Berlin, p. 737 (Portuguese East Africa: Tette); 1880, in Möbius, Beiträge Meeresfauna Mauritius Seychellen, p. 198. Crosse, 1881, Jl. de Conchyl., **29**, p. 196; Pl. 8, fig. 2 (epiphragm. Madagascar: Nossi-Bé). Grasset, 1884, Index Test. Viv. Coll., p. 199. Ancy, 1885, Bull. Soc. Mal. France, **2**, p. 139 (sinistral from Madagascar). Amaudrut, 1886, Bull. Soc. Philom. Paris, (7), **10**, p. 107 (nervous system). Martorell y Peña, 1888, Catálogo Colección Conchol. Museo Martorell, Barcelona, p. 56. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240. O. Boettger, 1889, Nachrichtsbl. D. Mal. Ges., **21**, p. 42 (Madagascar:

Loucoubé in Nossi-Bé). Bourguignat, 1889, Moll. Afr. Equat., p. 75. v. Martens, 1889, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 164 (Transvaal: Queens River near Barberton; Lebombo Mts. between Barberton and Delagoa Bay); 1890, *Op. cit.*, p. 86 (Transvaal: Kapaiva). E. A. Smith, 1891, Proc. Zool. Soc. London, p. 310. Dautzenberg, 1893, Bull. Soc. Zool. France, **18**, p. 79 (Seychelles: Mahé). Ancey, 1894, Mém. Soc. Zool. France, **7**, p. 219 (Nyasaland: outflow of Shiré River, 3 Kilom. S. of Lake Nyasa). Newton, 1895, Quart. Jl. Geol. Soc. London, **51**, pt. 1, pp. 72 and 87 (Madagascar: in Pleistocene deposits capping the hill of Ambohimarina, 1400 ft., in the N. part of the Id.). Ancey, 1897, The Nautilus, **10**, p. 105 (sinistral, Mauritius). Sturany, 1898, Denkschr. Ak. Wiss. Wien, Math.-Naturw. Cl., **67**, p. 592. v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 83 (Portuguese East Africa: Quilimane); 1897, Arch. f. Naturgesch., **63**, pt. 1, p. 54; 1898, Mitt. Zool. Mus. Berlin, **1**, pt. 1, pp. 22 and 30 (Seychelles: Mahé, from sea-level to 400 m.). Wiegmann, 1898, *Op. cit.*, **1**, pt. 1, p. 85, figs. on p. 86; Pl. 4, figs. 5-6 (anatomy of snails from Mahé). Melvill and Ponsonby, 1898, Proc. Mal. Soc. London, **3**, pt. 3, p. 178. Boucard, 1901, Cat. Coll. Coq. Terr., p. 49. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 41; Pl. 38, fig. 31 (after Férussac, Pl. 126); Pl. 39, fig. 32 (specimen from Madagascar; called *A. panthera lamarkiana* in Expl. of Plates, p. 226); Pl. 42, fig. 8 (epiphragm, after Brancsik); 1905, *Op. cit.*, (2), **17**, p. xii of Introduction; Pl. 62, figs. 22-24 (radula, jaw, after Wiegmann); Pl. 63, figs. 30-32 (anatomy, after Wiegmann). Sykes, 1905, Proc. Mal. Soc. London, **6**, pt. 5, p. 270 (sinistral). Ancey, 1906, Bull. Scient. France Belgique, **40**, p. 190 (sinistral). Julia E. Rogers, 1908, The Shell Book, p. 275. Sykes, 1909, Trans. Linn. Soc. London, Zool., (2), **13**, pt. 1, p. 63 (Seychelles: Mahé at Trois-Frères, 1500 ft., and Chateau Margot; Praslin; Silhouette). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, pp. 65, 90, 93, and 95. Rolle, 1910, *Op. cit.*, **32**, p. 191; Pl. 17, figs. 1a-b (2 views of scalariform abnormality from Mauritius) and 2 (sinistral, Mauritius). Connolly, 1912, Ann. South Afr. Mus., **11**, pt. 3, p. 197 (Southern Rhodesia: Sebakwe). Simroth, 1912, in Bronn's Klassen u. Ordnungen d. Tier-Reichs, **3**, Abt. 2, Book 2, Pulmonata, p. 564; Pl. 35, figs. 9-10 (anatomy, after Wiegmann). Dautzenberg, 1914, Bull. Soc. Zool. France, **39**, p. 57 (sinistral). Standen, 1917, Jl. of Conch., **15**, pt. 5, p. 160 (egg). Germain, 1918, Bull. Mus. Hist. Nat. Paris, **24**, p. 364 (Portuguese East Africa: Andrada); 1921, Mém. Soc. Zool. France, Vol. Suppl., p. 178 (Mauritius. Réunion); Pl. 10, figs. 3-4 (2 views of sinistral shell); Pl. 11, fig. 2 (umbilicate abnormality); Pl. 13, figs. 5-6 (2 views of monstr. *angulatum*). Connolly, 1925, Jl. of Conch., **17**, pt. 9, p. 263 (Rodriguez Id.); 1925, Trans. R. Soc. South Africa, **12**, pt. 3, p. 166 (Portuguese East Africa: Querimba Ids.; Quilimane; Tette; Inhambane; Rikatla; Andrada; Amatongas; Chinde; headwaters of Rio Tristão, Macequene District). Haas, 1929, Zool. Jahrb., Abt. Syst., **57**, pp. 396 and 411 (Comoros: Anjouan; Mayotte. Madagascar: Mananava, Antongil Bay, in E. part; Ste Marie de Madagascar; Andranohinaly, in S.W. part; Mojanga, in W. part). Connolly, 1931, Jl. of Conch., **19**, pt. 4,

- p. 103. Grandidier and Petit, 1932, Zoologie de Madagascar, p. 192. Germain, 1934, C. R. 67e Congrès Soc. Savantes, (1934), Sciences, pp. 123 and 128; 1935, Mem. Est. Mus. Zool. Univ. Coimbra, Ser. I, No. 80, p. 38 (Portuguese East Africa: Nova Choupanga near Chemba). Dupont, 1935, Trans. R. Soc. Arts Sci. Mauritius, Ser. C, No. 3, (1933-1934), p. 138 (Seychelles: Mahé; Silhouette; Praslin). Viader, 1937, Mauritius Inst. Bull., 1, pt. 2, p. 86. Connolly, 1939, Ann. South Afric. Mus., 33, pt. 1, p. 322 (earlier records repeated; adds Southern Rhodesia: Umtali; Marandellas. Two shells labelled Port Elizabeth were either introduced or wrongly labelled). Burton, 1949, Illustrated London News, 214, p. 120.
- Achatina* (*Archachatina*) *panthera* Albers, 1850, Die Helicen, p. 190.
- Achatina* (*Achatinus*) *panthera* Pfeiffer, 1856, Malak. Blätt., 2, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265. Römer, 1891, Jahrb. Nassau. Ver. Naturk., 44, p. 123.
- Achatina zebra* Sganzin, 1843, Mém. Soc. Hist. Nat. Strasbourg, 3, pt. 2, Cat. Coq. Iles de France, etc., p. 17 (Madagascar). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 90. Not of Bruguière, 1792.¹
- Achatina lamarekiana* Dohrn, 1865, Proc. Zool. Soc. London, p. 232 (Portuguese East Africa: Mozambique; Zambesi River). Not of Pfeiffer, 1847.
- Achatina zebra* var. γ Pfeiffer, 1853, Monogr. Helic. Viv., 3, p. 482 (with *A. eburnoides* "Sganzin" as synonym).
- "Achatine eburnoide" Sganzin, 1843, Mém. Soc. Hist. Nat. Strasbourg, 3, pt. 2, Cat. Coq. Iles de France, etc., p. 17 (scalariform abnormality; 2 shells from Ste Marie de Madagascar).
- Achatina eburnoides* Pfeiffer, 1853, Monogr. Helic. Viv., 3, p. 482 (as a synonym of *A. panthera* var. γ).
- Achatina perdis* de Man, 1877, Recherches Faune Madagascar Dépendances, Pt. 5, Livr. 3, pp. 2 and 18 (Madagascar: Nossi Bé). Not of Lamarek, 1822.
- ? *Achatina* (?) *panthera* de Man, 1877, Recherches Faune Madagascar Dépendances, Pt. 5, Livr. 3, pp. 2 and 18 (Madagascar: Pasandava Bay): Pl. 3, fig. 19.²
- Achatina pantherina* "Férussac" Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 53. G. Nevill, 1879, Hand List Moll. Indian Mus., 1, (1878), p. 145 (Mauritius; no description; error for *panthera* Férussac). v. Martens, 1897, Mitt. Naturh. Mus. Hamburg, 14, p. 114 (1901, Zool. Ergebn. Küstengebiete Ost-Afrika Reise Stuhlmann, 2, pt. 15, p. 4) (in part: specimen from Portuguese East Africa: Quilimane, with reddish columella).
- Achatina panthera* var. *sinistrorsa* Grasset, 1884, Index Test. Viv. Coll., p. 199 (Mauritius; no description).

¹ Bruguière's *Bulimus zebra* was originally a mixture of *A. panthera* from Madagascar and *A. zebra* (of later authors) from South Africa. The name was later restricted to the South African species.

² Although the colored figure shows a white columella, a feature which I have never seen myself in true *panthera*, the general shape and rough sculpture of strong growth-striae seem to refer this shell to *panthera* and not to *fulica*. Possibly the figure was made from a shell with discolored or faded columella.

- Achatina* (*Achatinus*) *fulva* O. Boettger, 1890, *Nachrichtsbl. D. Mal. Ges.*, **22**, p. 87 (Madagascar: Nossi-Bé at Loucoubé and Tafondro. — According to Haas, 1929, these shells were *A. panthera*). Not *Bulimus fulvus* Bruguière, 1792, nor *A. fulva* Beek, 1837.
- Achatina mossambica* Brancsik, 1893, *Jahresh. Naturw. Ver. Trenséner Comit.*, **15-16**, (1892-1893), p. 116 (Portuguese East Africa: Id. of Mozambique); Pl. 6, figs. 2 and 2a-b (anatomy only); Pl. 10, figs. 2a-b (outer and inner views of epiphragm).
- Achatina lechaptloisi* Ancey, 1894, *Mém. Soc. Zool. France*, **7**, p. 220 (Portuguese East Africa: Mozambique).
- ? *Achatina* sp. like *layardi* Newton, 1895, *Quart. Jl. Geol. Soc. London*, **51**, pt. 1, pp. 72 and 87 (Madagascar: Pleistocene deposits capping the hill of Ambohimarina, 1400 ft., in N. part of the Island).
- Achatina panthera* monstr. *sinistrorsum* Dautzenberg, 1909, *Jl. de Conchyl.*, **57**, p. 41; Pl. 1, fig. 3 (Mauritius); 1911, *Op. cit.*, **58**, (1910), p. 315.
- Achatina panthera* monstr. *angulatum* Dautzenberg, 1911, *Jl. de Conchyl.*, **58**, (1910), p. 314; Pl. 14, fig. 1 (Mauritius). Germain, 1921, *Mém. Soc. Zool. France*, Vol. Suppl., p. 181; Pl. 13, figs. 5-6 (2 views of one shell).
- Achatina panthera* monstr. *canaliculatum* Dautzenberg, 1911, *Jl. de Conchyl.*, **58**, (1910), p. 314 (no locality; 2 shells).
- Achatina panthera* monstr. *umbilicatum* Dautzenberg, 1911, *Jl. de Conchyl.*, **58**, (1910), p. 315; Pl. 14, fig. 3 (Mauritius; Madagascar).
- Achatina panthera* monstr. *contabulatum* Dautzenberg, 1911, *Jl. de Conchyl.*, **58**, (1910), p. 314 (specimen without locality; refers to it also Rolle's Pl. 17, figs. 1a-b of 1910).
- Achatina panthera* monstr. *compressum* Dautzenberg, 1911, *Jl. de Conchyl.*, **58**, (1910), p. 315; Pl. 14, fig. 2 (Madagascar; Mauritius).¹
- Achatina panthera* var. *mossambica* Kobelt, 1910, *Abh. Senckenberg. Naturf. Ges.*, **32**, p. 65.
- Achatina panthera* var. *berevoensis* Clench and Archer, 1930, *The Nautilus*, **43**, p. 85 (Madagascar: forest between Mahabo and Berevo; Berevo; 10 miles S. of Berevo; no type locality and no holotype selected).

Pilsbry (1904) and Germain (1921) also cite de Montfort's figure of *Achatinus* (1810, *Conchyl. Systém.*, **2**, p. 418), but not the accompanying text, in the synonymy of *A. panthera*. In my opinion this figure is unrecognizable and bears only a superficial resemblance to *A. panthera*.

Although Férussac gave no description of his *Helix panthera*, he published the trivial name validly in 1832 in the engraved caption of his Pl. 126. The two figures of this plate (one of which is copied in my Pl. 58, fig. 3) are the type figures of the species and are two views of one shell. Fig. 1 is 151 mm. long, 75 mm. in greatest width, with

¹ Dautzenberg credits some of his names of abnormalities to Rolle. It should be noted that Rolle gave a name in print only to *A. fulica* var. *umbilicata*; although he may have distributed some of the others with manuscript names.

the aperture 75 by 41 mm. The type specimen may yet be in existence in some collection, but I have been unable to trace it thus far.¹ It could not be shown to me at the Paris Museum in 1933 and it has not been found there since (Dr. E. Fischer, *in litt.*, 1949). Fortunately Férussac's figures leave no doubt as to the identity of the species.

The first formal description, by Deshayes (1838), is as follows (French text translated): "A. testa ovato-oblonga, solida, apice obtusa albo-grisea; strigis longitudinalibus fusco violaceis vel flavis ornata; anfractibus convexis ultimo spira brevior; apertura ovata, albo-coerulea; columella contorta, labroque roseis. Fine and large shell, which has some analogy in shape with *Achatina fulva* [Deshayes' *A. fulva* was *A. fulica*], but is in proportion shorter and more ventricose. There are 8 whorls to the spire, which are convex, with the suture simple, smooth or scarcely striate by the growth additions. The apex is obtuse and whitish. On the succeeding whorls some fulvous flammules appear; these become broader and darker on the penultimate whorl; but on the body-whorl they form broad zones of a very intense brown, often shading by scarcely perceptible stages into the ash-gray background. The aperture is oval, oblong, bluish-white inside, white along the right margin [outer lip]; the left margin [parietal wall] and the columella are a beautiful rose color. The columella, strongly twisted on itself, has its end [base] produced forward and outward. It is much shorter than the right margin [outer lip] and its truncation is deep. This shell, one of the largest of the genus, is 15 cm. long and 75 mm. wide." It may be noted that the measurements and description fit Férussac's Plate 126 nicely. This does not necessarily mean, however, that Deshayes saw Férussac's type specimen, as the description may have been written from the figures.

Original description of *A. mossambica* Brancsik (1893) (German text translated): "T. solidissima, ovato-oblonga, ventricosa, longitudinaliter sulcato striata, nitida; livide fulva, striis ac apice pallidioribus, anfractibus superis rufi flammulatis, caeteris irregularibus flammulis ac maculis fulvo-coerulescentibus; columella truncata, rosea, apertura oblongo-ovalis, intus rosacea, interdum caerulescens; peristoma simplex, crassum, margine columellari late calloso, rosaceo; spira conica, acutiuscula; anfractus 8 convexiusculi, 3-7 striis transversis reticulatis, ultimus longitudinem spirae multo superans." Dimensions of 7 specimens in mm.: 1. Length, 168; width, 55; length of aperture, 95 ("exempl. ventricosissimum"). 2. L., 158; w., 49; 1. of a.,

¹ Germain (1935, p. 39, footnote) says that "the type of Férussac's *A. panthera* has the parietal margin and the columellar margin white." This can hardly be reconciled with Férussac's Pl. 126 where both columella and parietal wall are fairly uniformly reddish. Germain's measurements of the "figured" type were probably taken from Férussac's figures, the length given (120 mm.) being a misprint or slip for 150 mm.

87. 3. L., 152; w., 45; l. of a., 88 ("exempl. minus crassum"). 4. L., 146; w., 44; l. of a., 81. 5. L., 145; w., 44; l. of a., 79. 6. L., 141; w., 38; l. of a., 71 ("exempl. angustissimum"). 7. L., 137; w., 38; l. of a., 83 ("exempl. minus crassum"). "Very ventricose, with conical, rather acute spire, readily separated at first glance from *A. panthera*. The columellar margin of the aperture is much less obtusely curved inward in the middle than in *panthera* and all margins are colored pink, this color acquiring a bluish tinge inside. The striation particularly on the body-whorl is very coarse." The present location of the cotypes is unknown. The description was, however, clearly based on typical specimens of *A. panthera*, which is common in the region of Mozambique, and with which Pilsbry (1904) first synonymized it.

Original description of *A. lechaptouisi* Ancey (1894) (French text translated): "Testa solida, crassa, parum nitida, ovata, superne conico-attenuata, ventricosa, lineis incrementi passim rudibus exarata et, summo excepto, striis spiralibus in supremis anfractibus approximatis et granulosis efficientibus, in inferioribus magis remotis et e medio ad basin obsolete notatis reticulata, sordide albida, fusco et caerulescentigriseo late irregulariterque flammeata et maculosa, apice pallido, minuto. Spira conica, anfractibus 7, sutura irregulariter impressa separati, convexiusculi, regulariter crescentes; ultimus maximus, ovato-ventrosus, caeteros longitudine superans. Apertura magna, basi subpatula, intus albescens, ad marginem exterum roseo-tincta; columella crassa, oblique ad basin truncata, fere recta, vix contorta, cum callo parietali crasso rosea. Long. 125, lat. 75, alt. apert. 77 mill. This well characterized species has the general color of *panthera*, but has a very peculiar appearance owing to the length of the body-whorl; in this respect, but in this only, it has a certain analogy with *variegata* [*A. achatina*] of the West Coast of Africa." I have been unable to trace the present whereabouts of Ancey's type. As noted by Pilsbry (1904), *lechaptouisi* is "exactly equivalent to *mossambica*, except in being a little smaller." It was probably based on an immature shell.

Original description of *A. panthera* var. *bererocensis* Clench and Archer (1930): "Shell acutely ovate, moderately solid, the ground color of the nuclear whorl whitish shading off into a pinkish buff on the body whorl, and marked throughout by somewhat irregular chocolate streaks. Nearly every streak on the body whorl is washed on the right with deep neutral grey. Surface covered with axial striae. Each whorl covered with fine spiral lines with the exception of the body whorl where they appear only in a region extending about 15 mm. below the suture. Whorls $6\frac{1}{2}$ to 7. Aperture obliquely ovate, bluish grey within, outer lip slightly buff pink, columella and parietal

callus white tinged on the outer lip with coral red. Columella sharply truncate, slender, and curved outwards. Base of lip quite flaring, lip itself marginate. This variety differs from *A. panthera*, *s. s.* as figured by Férussac, Prodr., p. 49, no. 349; Hist., pl. 126, and as figured by Pilsbry, M. of C. (2), Vol. 17, p. 41, pl. 38, fig. 31, 1904, in the following respects: The shell is smaller, the pinkish buff ground color is spread over the body whorl contrasting with the lighter ground color of the species proper; the streaks are further apart and set in straighter lines, and contrast with those of *A. panthera*, by the less pronounced wash of neutral grey on the right; the axial striae are not so deep, while the spiral lines on the last whorl differ in being confined to a narrow subsutural area, as compared with *A. panthera* where they may be absent, or if present are scattered at irregular distances. The spire is slightly less acute; the aperture narrower as regards its length, and less ovate. The columella is slenderer, and from a side view is more concave than *A. panthera*." The measurements given for 3 cotypes are respectively: length, 133, 122 and 122 mm.; width, 71, 68 and 68; length of aperture, 68, 63 and 66 mm.; width of aperture, 40, 35 and 35.5. This form has not been figured thus far. I have studied all three cotypes. They are in poor condition and apparently immature. The best preserved example, from Bérévo (M.C.Z. No. 31077), is 122 mm. long and clearly abnormal, the summit being very broad as if the early whorls had been crushed in and repaired by the animal; it shows more traces of pink on the columella than either of the others. The shell from 10 miles S. of Bérévo (M.C.Z. No. 31079) is 120 mm. long, very bleached, with the columella almost white. The specimen from between Mahabo and Bérévo (M.C.Z. No. 31078), herewith selected as the lectotype and shown in my Pl. 5, fig. 3, also bleached and with nearly white columella, is otherwise the most normal shell; it measures 132 mm. in length, 71 mm. in greatest width, of $7\frac{1}{2}$ whorls, with the aperture 71.5 by 40 mm. I can find no characters by means of which these specimens could be separated from the nominate race of *panthera*.

Specimens Examined. MADAGASCAR: without precise locality in most collections (M.C.Z.; A.M.N.H.; Ac.N.S.Phila.; U.S.N.M.; Amst.M.; Leid.M.; Brus.M.; Berl.M.); Bérévo, cotype of *berevoensis* (F. R. Wulsin.-M.C.Z. No. 31077); between Mahabo and Bérévo, cotype (now selected as lectotype) of *berevoensis* (F. R. Wulsin.-M.C.Z. No. 31078); 10 miles S. of Bérévo, cotype of *berevoensis* (F. R. Wulsin.-M.C.Z. No. 31079); Nossi-Bé (Berl.M.). — PORTUGUESE EAST AFRICA: Mozambique (E. L. Layard.-A.M.N.H.; M.C.Z.); Lumbo near Mozambique (A. Loveridge.-M.C.Z.); Villa Machado R. Allen and R. M. de Schauensee.-Ac.N.S.Phila.). — Also many

specimens in various collections labelled "East Africa" and some "Zanzibar", the latter locality in my opinion open to question; I have seen no specimens that had been reliably collected in Zanzibar Id., and neither Gibbons nor Williams found it there; in the early days many shells were labelled from "Zanzibar" because they had been shipped from there to Europe, although they actually came from some part of the East African coast.

There are published records, apparently reliable, of the large nominate race of *panthera* from the extreme eastern sections of Nyasaland, Southern Rhodesia and Transvaal, although in this area it seems to be replaced in certain localities by the small race *lamareckiana*. All the specimens I have seen from Mauritius were *lamareckiana*. The species has been recorded from the Comoros, Réunion, and the Seychelles; but I have seen no specimens from there and do not know what race is involved.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
163.5 mm.	85	91	49	8		Mozambique
161	85	87	49	8		Lumbo
154	79	89	41.5	8		East Africa
153	83	82	44.5	8		Mozambique
137	73	75.5	38	7½		Madagascar

The largest specimens on record appear to be the one at the British Museum measured by Connolly (1939), locality not given, 195 mm. long, 92 mm. wide; and the cotype of *mossambica*, the length of which is given by Brancsik (1893) as 168 mm.

Abnormal shells appear to be rather frequent in this species and several authors have described them, as listed in the bibliography. A sinistral example is shown in my Pl. 38, fig. 2, and a scalariform shell in my Pl. 56, fig. 2.

It should be emphasized that there is at present no reliable evidence of *A. panthera* occurring outside East Africa, Madagascar, the Mascarenes and the Seychelles. This species was not introduced into Southern Asia, the East Indies or the Pacific Islands. The few references in popular writings to its supposed occurrence in the latter area were due to a confusion with *A. fulica*. They may have been caused by *A. leucostyla* being originally described by Pilsbry as a variety of *A. panthera*. As shown previously in this paper, *leucostyla* was based on specimens of the continental East African race of *A. fulica*, for which the oldest valid name appears to be *hamillei* Petit.

b. *A. PANTHERA LAMARCKIANA* Pfeiffer

Pl. 35, figs. 2-3; Pl. 38, fig. 1; Pl. 55, fig. 2; Pl. 76, fig. 2

- Achatina lamarckiana* Pfeiffer, 1846 (January 26), Proc. Zool. Soc. London, (for 1846), p. 115 (interior of the Id. of Madagascar); 1847 (April), Ann. Mag. Nat. Hist., **19**, p. 269 (copy of original description); 1848, Monogr. Helic. Viv., **2**, p. 253; 1853, *Op. cit.*, **3**, p. 483. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 601. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 201. Haines, 1868, Cat. Terr. Shells Coll., p. 67. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 213; 1876, *Op. cit.*, **8**, p. 273. Clessin, 1878, Jahrb. D. Mal. Ges., **5**, p. 179. Grasset, 1884, Index Test. Viv. Coll., p. 199. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240. E. A. Smith, 1891, Proc. Zool. Soc. London, p. 310. Boucard, 1901, Cat. Coll. Coq. Terr., p. 49. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 90.
- Achatina (Achatinus) lamarckiana* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 123.
- Achatina lamarkiana* A. D. Brown, 1861, Cat. Shells Coll., p. 55. Paetel, 1869, Moll. Syst. Cat., p. 80; 1873, Cat. Conch.-Samml., p. 99. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 53.
- Achatina lamarcki* Germain, 1918, Bull. Mus. Hist. Nat. Paris, **24**, p. 365.
- Achatina panthera* var. *minor* Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., Explanation of Plates of Atlas, p. 19; Atlas, Pl. 132, figs. 1-2 (2 views of one shell; no locality. Plate published, without name, by Deshayes, after Férussac's death, presumably in 1851). Godet, in Junod, 1899, Bull. Soc. Vaudoise Sci. Nat., (4), **35**, No. 133, p. 278 (no description; defined by the reference to Férussac's Pl. 132, figs. 1-2. Portuguese East Africa: Rikatla. Egg).¹ Connolly, 1939, Ann. South Afric. Mus., **33**, pt. 1, p. 323 (Portuguese East Africa: Rikatla; Macequece District. Southern Rhodesia: Mt. Selinda; Selinda Forest).
- Achatina panthera* var. E. A. Smith, 1899, Proc. Zool. Soc. London, p. 589; Pl. 34, fig. 1 (Nyasaland: Zomba). Pilsbry, 1904, Man. of Conch., (2), **17**, p. 44; Pl. 38, fig. 30 (after E. A. Smith).

Original description of *A. lamarckiana* Pfeiffer (1847): "Ach. testa ovato-conica, solida, ponderosa, ruditer plicata, in fundo albido strigis fulminatis nigricantibus et castaneis, maculisque rufis variegata; spira conica, pallida, apice obtusiusculo; anfractibus 8 convexiusculis, supremis lineis spiralibus obsolete decussatis, ultimo ventroso, spiram superante; columella arcuata, purpureo-callosa, supra basin aperturæ oblique et leviter truncata; apertura ovali, intus margaritacea, caerule-scente, saturatius marmorata; peristomate fusco-limbato, marginibus

¹ Some authors credit the name *minor* to Junod; but it seems clear, from the introductory remarks by Junod, that all names were given by Godet, who moreover cites Férussac as the author of the name.

callo purpureo junctis. Long. 103, diam. 52 mill." In 1848 Pfeiffer added to this diagnosis that the aperture was 58 mm. long and 34 mm. wide. The unfigured type came from the Cuming Collection, later mostly acquired by the British Museum. No specimen labelled "*lamareckiana*" is now to be found there, so that the type must be considered lost.¹ According to the measurements it was a dwarf example of *panthera*, being even smaller than the one figured by Deshayes (as var. *minor*). In 1853, Pfeiffer cites Deshayes' Pl. 132, figs. 1-2, in the synonymy of *lamareckiana*. If the dwarf specimens are to be given varietal or subspecific status they should be called *lamareckiana*. Pilsbry (1904) pointed out that, at the time he described *lamareckiana*, Pfeiffer believed that true *panthera* had a white columella. He was deceived by his specimen of *panthera* (described by him in 1848, p. 253, and figured in 1860, Pl. 28, fig. 1) having a bleached columella. Moreover, in his figure the columella is not pure white, but is faintly tinged with roseate, at any rate in the copies of the Conchylien-Cabinet I have examined. This figure has the shape and coarse sculpture of *panthera* and its size (132 mm.) is that of the nominate race.

Connolly (1939) gives the following account of the dwarf race of *A. panthera*: "The form actually mentioned by Junod is referred to that figured on Pl. 132 of Deshayes' *Histoire*, which measures alt. 108, lat. 57; apert. alt. 59, lat. 30; last whorl 85 mm., and his varietal name seems applicable to the beautiful race from Nyasaland figured by Smith, which shows the typical *panthera* colour pattern and most brilliant rosy peristome and columellar region, is extremely solid with unusually thick lip, and columellar truncation less pronounced than in the larger form. Its dimensions are very constant in such localities as those wherein I have noticed its occurrence, and I have no evidence of its ever having been collected in company with the larger form. An example from Mt. Selinda measures: alt. 95, lat. 44; apert. alt. 46.4, lat. 23.3; last whorl 70 mm."

It seems to have been generally overlooked that the varietal name *minor* was first applied to this dwarf form by Deshayes in 1851, figs. 1-2 of Pl. 132 in the Atlas to Férussac's work being the type figures for both Deshayes' and Godet's names. One of Deshayes' figures is copied in my Pl. 76, fig. 2. Smith's (1899) variety from Zomba was "small and rather slender in comparison with the typical form figured by Férussac. The largest specimen is only 125 mm. in length, although consisting of $8\frac{1}{2}$ whorls, the number possessed by a large typical

¹ The original label may have been destroyed by Cuming, since as early as February, 1849, Reeve treated *lamareckiana* as a synonym of *panthera*. Reeve then figured also an example from the Cuming Collection, but of the nominate race, 136 mm. long.

example from Mozambique, 157 mm. long. A very small specimen, which probably would not have grown larger, has a length of only 93 mm." Godet (1899) gave no measurements of his Rikatla shells.

Pilsbry (1904, p. 45) noted that similar dwarf specimens of *panthera* occur also in Madagascar. One of these he describes as follows: "smaller than the typical form, solid, rather narrow, of a dull livid or purplish shade with narrow, crowded, indistinct mottling. Columella and inner edge of lip rose. Outer lip thickened within. Length 115, diam. 55, aperture 59 mm. A similar shell has been figured by Deshayes in Férussac, Pl. 132, figs. 1-2." In this connection it may be noted that although Deshayes gave no locality, the shell which was figured on his Pl. 132 most probably came from Madagascar. In the rather limited material of *panthera* which I have seen, the dwarf form predominates among the shells from Madagascar and Mauritius, and is the only one present from Nyasaland.

Specimens Examined. MADAGASCAR: without precise locality (M.C.Z.).—MAURITIUS: without precise locality in many collections (M.C.Z.; A.M.N.H.; U.S.N.M.; Ac.N.S.Phila.; Berl.M.; etc.).—PORTUGUESE EAST AFRICA: Inhambane (M.C.Z.); Cape Delgado (M.C.Z.).—NYASALAND: Mtimbuka at the southern end of Lake Nyasa, 1949 (A. Loveridge.-M.C.Z.); Blantyre, 1948 (A. Loveridge.-M.C.Z.); 40 miles East of Blantyre, 1949 (A. Loveridge.-M.C.Z.); Mt. Chiradzulu, 3900 ft. (A. Loveridge.-M.C.Z.); Cholo Mountains, 20 miles South of Blantyre (A. Loveridge.-M.C.Z.); MacDonald's Camp, Vipya Plateau, 6000 ft., Mombera District (A. Loveridge.-M.C.Z.); Kasonga, Zomba Plateau, 5000 ft. (A. Loveridge.-M.C.Z.).

The smaller race of *A. panthera* occurs also in certain localities of Southern Rhodesia.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
138 mm.	64	70	35	8½		Blantyre
118	63	64	34	7½		Mauritius
115.5	54	60	28	7½		No locality
114	56	60.5	31	7½		40 mi. E. Blantyre
111	59	60	34	7½		Madagascar
110	56	60	31.5	7½		"
104.5	54	58	28.5	7½		Mauritius
101	51	58.5	26.5	7½		Inhambane
100	53	60	29	7½		Mauritius
93	45	49	24	7½		"
92	52	54	28	7		"
89	45.5	48.5	23.5	7		"
82	42.5	43	23	7		Madagascar

The small specimen from Madagascar figured by Pilsbry (1904, Pl. 39, fig. 32), 120 mm. long, was evidently also of the dwarf race here called *lamarkiana*. The measurements listed above give for the subsp. *lamarkiana* an average length of 105 mm. and an average width of 53 mm.; while my measurements of nominate *panthera* give corresponding figures of 153 mm. and 80 mm. The relations between the two races of *panthera* appear therefore to be of much the same type as those existing between nominate *A. fulica* and its subsp. *hamillei*.

c. *A. PANTHERA ANTOUTOURENSIS* Crosse

Pl. 25, fig. 4; Pl. 79, fig. 1

Achatina antoutourensis Crosse, 1879, Jl. de Conchyl., **27**, p. 340 (Madagascar: Antourtour in Nossi-Bé); 1881, *Op. cit.*, **29**, p. 197; Pl. 8, fig. 1 (type). Kobelt, 1881, Synopsis Moll. Viv. Test. 1879 Promulgat., p. 137. Grasset, 1884, Index Test. Viv. Coll., p. 199. Crosse and Fischer, 1889, in Grandidier, Hist. Phys. Nat. Pol. Madagascar, **25**, Moll., Atlas, pt. 1, Pl. 20, figs. 3 (2 views of type). Pilsbry, 1904, Man. of Conch., (2), **17**, p. 46; Pl. 35, fig. 16 (after Crosse and Fischer, 1889). Kobelt, 1910, Abb. Senckenberg. Naturf. Ges., **32**, p. 65.

Achatina antoutourensis Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 239. *Achatina anturturensis* O. Boettger, 1890, Nachrichtenbl. D. Mal. Ges., **22**, p. 82.

Original description of *A. antoutourensis* Crosse (1879): "T. im^r perforata, oblongo-conica, sat tenuis sed solidula, longitudinalite striato-plicata, transversim subdistanter et vix conspicue striatula' haud nitens, sub epidermide pallide lutea, decidua, fere omnino deficiente, unicolor, alba; spira sat elongata, apice planato, medio vix concaviusculo; sutura sat irregulariter impressa, sublaciniata, anfractus $7\frac{1}{2}$, convexiusculi, regulariter accrescentes, embryonales primi 2 laeves, nitiduli, ultimus subdescendens, spirae longitudinem paulo superans, infra medium subinflatus, basi rotundatus, leviter attenuatus; apertura angulato-ovata, piriformis, intus nitida, unicolor, alba; peristoma simplex, nitidum, album, marginibus callo crassiusculo, concolore junctis, columellari arcuato, dilatato, reflexiusculo, basi truncato, basali rotundato, subincrassato, externo vix crassiusculo. — Longit. 90, diam. maj. 41 mill." Crosse's later description (1881) is a literal translation of the Latin diagnosis. I saw the figured holotype in 1933 in the collection of the "Journal de Conchyliologie," when it was in the custody of the late Mr. P. Dautzenberg. It is now in the care of Dr. E. Fischer-Piette, who sent me the photograph shown in my Pl. 79, fig. 1. Although this form has not been found

again, so far as I know, it was originally taken in some number, as it was distributed to several collections, where I saw paratypes. All these shells are very similar. The original figure (1879) is copied in my Pl. 25, fig. 4.

A. antourtourensis appears to be a depauperate albino race of *A. panthera*, remarkable not only for the total lack of color in the material of the shell, the very pale dirty-yellowish periostracum, and the pure white columella, but also for the small size, slenderness and lightness. The outline (particularly the relative length of body-whorl and spire), the shape of the aperture, and the type of sculpture are those of *panthera*, not of *fulica*.

Specimens Examined. MADAGASCAR: Antourtour in Nossi-Bé, figured holotype and several paratypes (Par.M.; Brus.M.; Leid.M.; M.C.Z.; Ac.N.S.Phila.; A.M.N.H.).

Measurements of Adult Shell

Length	Greatest	Aperture		Whorls	
	Width	Length	Width		
86 mm.	42	46.5	23	7½	Antourtour, paratype

ACHATINA (LISSACHATINA) ZANZIBARICA Bourguignat

Pl. 1, fig. 2; Pl. 4, fig. 2; Pl. 16, fig. 1; Pl. 36, fig. 3; Pl. 37, figs. 3 and 5; Pl. 41, fig. 2; Pl. 47, fig. 2; Pl. 59, fig. 2; Pl. 73, fig. 4; Pl. 77, fig. 5; Pl. 78, fig. 1; Pl. 79, figs. 3-4

Achatina zanzibarica Bourguignat, 1879, Descr. Moll. Egypte Abyssinie Zanzibar, p. 5 (Nasimoya in Zanzibar). Kobelt, 1881, Synopsis Moll. Viv. Test. 1879 Promulgat., p. 138. Bourguignat, 1889, Moll. Afr. Equat., p. 75. Pactel, 1889, Cat. Conch.-Samm., 4th Ed., 2, p. 241. v. Martens, 1897, Deutsch-Ost-Afrika, 4, Beschalte Weichth., p. 86 (Tanganyika Territory: Bagamoyo; Buloa [=Bulwa] near Tanga; Usambara; Masai Steppe; Lake Jipe; Kitohau, S. W. of Sadi Makangele in S. E. section); 1897, Arch. f. Naturgesch., 63, pt. 1, p. 54; 1897, Mitt. Naturh. Mus. Hamburg, 14, p. 114 (1901, Zool. Ergebn. Küstengebiete Ost-Afrika Reise Stuhlmann, 2, pt. 15, p. 4). Pilsbry, 1904, Man. of Conch., (2), 17, p. 51. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 66. Thiele, 1911, Wiss. Ergebn. D. Zentr.-Afr. Exped. (1907-1908), 3, p. 205. C. R. Boettger, 1913, Proc. Mal. Soc. London, 10, pt. 6, p. 351; Pl. 16, fig. 2 (cotype of *A. usambarensis* Rolle). Germain, 1916, Bull. Mus. Hist. Nat. Paris, 22, p. 255 (Tanganyika Territory: Kipatimu in Kilwa district; Kwiro in Mahenge district); 1935, Mem. Est. Mus. Zool. Univ. Coimbra, Ser. I, No. 80, p. 40, footnote. Reh, 1925, in Sorauer, Handbuch der Pflanzenkrankheiten, 4th Ed., 4, p. 73 (damaging plants in Tanganyika Territory).

- Leptocala* (*Leptocallista* ?) *zanzibarensis* "Bourguignat" Coen, 1945, Catalogo Gasteropodi Polmonati Coll. Coen, p. 43 ("Kuriro" = Kwirow, Tanganyika Territory). Misspelling of *zanzibarica*.
- Achatina lhotellerii* Bourguignat, 1879, Descr. Moll. Egypte Abyssinie Zanzibar, p. 7 (Nasimoya in Zanzibar). Kobelt, 1881, Synopsis Moll. Viv. Test. 1879 Promulgat., p. 137. Bourguignat, 1889, Moll. Afr. Equat., p. 73. Ancey, 1902, Jl. de Conchyl., **50**, p. 273, fig. 1 on p. 274 (specimen named by Bourguignat from Tanganyika Territory: Mswa in Ukuere).
- Achatina zanzibarica* var. *lhotellerii* v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 86 (Tanganyika Territory: Usambara). Pilsbry, 1904, Man. of Conch., (2), **17**, p. 53. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66. C. R. Boettger, 1913, Proc. Mal. Soc. London, **10**, pt. 6, p. 351; Pl. 16, fig. 3.
- Achatina lhotelleriei* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240.
- Achatina zanzibarica* *lhotellerii* Loveridge, 1928, Proc. Zool. Soc. London, p. 126 (viviparity. Tanganyika Territory: Amani).
- Achatina usambarensis* Rolle, 1895, Nachrichtsbl. D. Mal. Ges., **27**, p. 100 (Tanganyika Territory: Nguelo in Usambara). Cotype figured by C. R. Boettger, 1913.
- Achatina usambarica* v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 86 (misspelling of *usambarensis* Rolle; as a synonym of *A. zanzibarica*).
- Achatina zanzibarica* var. *naegelei* C. R. Boettger, 1913, Proc. Mal. Soc. London, **10**, pt. 6, p. 351; Pl. 16, fig. 4 (Tanganyika Territory: Kwirow near Mahenge).
- Achatina kilimae* var. *rollei* C. R. Boettger, 1913, Proc. Mal. Soc. London, **10**, pt. 6, p. 351; Pl. 16, fig. 1 (Tanganyika Territory: Bulwa [=Bulwa near Tanga], in Usambara).
- Achatina madaziniana* Clench and Archer, 1930, Occ. Papers Boston Soc. Nat. Hist., **5**, p. 299 (Tanganyika Territory: Madazini, holotype; Itende, paratype); Pl. 16, fig. B (holotype). (?) C. R. Boettger, 1947, Arch. f. Molluskenk., **76**, p. 100; Pl. 2, fig. 7 (Tanganyika Territory: in Pleistocene deposits on the Garussi River, N.W. of Lake Njarasa [=Nyaraza or Eyasi]).
- Achatina* sp. Vosseler, 1906, Berichte Land-Forstwirtschaft, Amani, **2**, pt. 7, p. 406 (damaging sisal at Amani). Kränzlin, 1909, Der Pflanzer, Tanga, **5**, p. 182 (damaging crops in East Africa). Morstatt, 1911, *Op. cit.*, **7**, p. 72 (damaging crops in East Africa). The snails observed by these authors were referred to *A. zanzibarica* by Reh (1925).

Original description of *A. zanzibarica* Bourguignat (1879): "Testa oblongo-tumida, in medio ventrosa, utrinque attenuata, parum ponderosa, obscure passim subtranslucida, nitida, ad superiores rosacea, ad tres inferiores epidermide luteo (epidermis sat fugax, facile squamans), in ultimo saturatiore, induta, et strigis ad apicem fulvo-flammulatis, ad medianos atro-castaneis flammulato-fulguratis,

inter se confluentibus, in ultimo prope aperturam castaneo-olivaceo-flammulatis, eleganter ornata; in supremis laevigata, in medianis valide costata (costae praesertim in antepenultimo penultimoque sulcis longitudinalibus decussatae), in ultimo ample plicatula (plicae obtusae, passim evanidae ac hebetes) et circa suturam eleganter plicosa; spira regulariter acuminata, relative parum producta; apice rosaceo, obtuso, submamillato; anfractibus 8 convexis, regulariter crescentibus, sutura (inter ultimos subplicosa) separatis; ultimo oblongo, amplo, dimidium altitudinis superante; apertura leviter obliqua, acuminato-oblonga, intus intense caerulecente, externe exacte convexa, inferne attenuata, non dilatata; columella subcaerulea, fere recta, leviter contorta, basi abrupte truncata; callo tenui, subdiaphano ac subcaeruleo. Alt. 117 mill., diam. 57 mill.; alt. apert. 65, diam. ap. 30." The following additional notes are translated from the French: "It resembles most *A. schweinfurthi*, from which it differs in the smaller size, the less elongate spire (the swollen part of *zanzibarica* is exactly at about half-length; in *schweinfurthi* it is more basal, instead of being median it is pronounced at about two-thirds of the height measured from the apex), the body-whorl being longer than half the total height (in *schweinfurthi* it is the opposite), the more oblong aperture, which is more acuminate above, the whitish not bluish inside, the less arched columella, etc." I saw the unfigured holotype at the Paris Museum in 1933 and, after comparing it with the type of *lhotellerii*, recognized it as a slightly more obese example of the same species. It is shown in Pl. 79, fig. 3, a photograph received from Dr. E. Fischer.

Original description of *A. lhotellerii* Bourguignat (1879), translated from the French: "Species of the same shape as *A. zanzibarica* and having about the same sum total of characters, but differing nevertheless in: 1. The smaller size in all parts (97 mm. high, 49 in diameter, with the aperture 56 by 24). 2. The less ventricose shape, so that it seems a little more elongate. 3. The less convex whorls. 4. The shorter, more acuminate spire. 5. The more elongate-ovate penultimate whorl and the less swollen body-whorl. 6. The relatively more elongate, less wide aperture, which is whitish inside, tinged in places with horny or light bluish. 7. The outer margin less convex, particularly in the lower portion, which makes the aperture look more narrowed at the base. 8. The more regular flammulae, which do not join on the penultimate whorl as those of *zanzibarica*. 9. The truncation at the base of the columella not so abrupt and not having as pronounced a siphon-like appearance." The unfigured holotype, seen at the Paris Museum in 1933, proved to be a somewhat more slender specimen of *zanzibarica*. Both variants in shape, as well as some others, are among

the fairly large series of this species collected by Mr. A. Loveridge in Usambara. Ancey's (1902) rather poor figure was drawn from an unusually large shell for the species; but an example from Amani, collected by J. Vosseler and received from the Berlin Museum as *A. zanzibarica*, is about the same size (114 mm.). A photograph of Bourguignat's holotype, recently received from Dr. E. Fischer, is reproduced in my Pl. 78, fig. 1.

Original description of *A. usambarensis* Rolle (1895): "T. ovata, solidula, ruditer costato-striata, costis aperturam versus majoribus, irregularibus, spiraliter irregulariter impresso-sulcata, strigis luteo castaneis fulminulatis in anfractibus superis angustioribus in inferis latis maculisque transversis interdum sagittiformibus ornata. Spira conica, apice obtusulo. Anfractus 8-9 convexiusculi, sutura impressa inter inferos crenulata discreti, ultimus subelongatus celerius descendens, $\frac{3}{5}$ altitudinis occupans. Apertura ovata, supra acuminata, intus albido-coerulea strigis translucentibus; columella callo tenuissimo nitido in pariete aperturali vix conspicuo induta, basi exciso-truncata, basin testae haud attingens. Alt. 110, diam. 55, alt. apert. obl. 60 mm." The following remark is added in German: "In appearance like *A. fulica*, but quite distinct in color and sculpture." The present location of the unfigured type, corresponding to Rolle's measurements, is not known. The only figure in existence is that of a cotype (at Frankf.-M.) by C. R. Boettger (1913), only 93 mm. long, 45 mm. wide, with the aperture 59 by 21.5 mm. This figure is copied in my Pl. 16, fig. 1. Both v. Martens (1897) and C. R. Boettger synonymized *usambarensis* with *zanzibarica*, I believe correctly. Boettger's specimen was much more slender than Rolle's holotype and the figure can be duplicated among the *A. zanzibarica* I have seen from Amani. On the other hand, two shells at U.S.N.M., bought from Rolle as *A. usambarensis* var., from the type locality (Nguelo) and therefore possibly paratypes, have more the proportions of the holotype, being respectively 90.5 and 91 mm. long, 50 and 49.5 mm. wide, of $7\frac{1}{2}$ whorls, with the aperture 54 and 53 mm. by 25 and 26 mm.

Original description of *A. kilimae* var. *rollei* C. R. Boettger (1913): "Differt a typo colore et pictura. Testa flava, flammulis nigro-brunneis ornata; flammulae in medio anfractuum interdum zigzag-formes, confluentesque. Anfractus superiores subtiliter rosaceae. Testa indistincte granulata, subnitens, solida. Long. 88, diam. 43 mm.; apertura, alt. 47.5, lat. 25.5 mm. This new variety differs from the typical *Achatina kilimae* in colour and painting. The shell is straw-yellow, ornamented with blackish chestnut stripes, which in the median zone of the whorls sometimes become zigzag, flammulate, and confluent. The upper whorls are pale roseate, but never so intensely

coloured as in *A. zanzibarica* Bourg. and its allies. The granulation of the shell is not so distinct as in that species, and the shell has more lustre and is heavier. I have also a specimen before me which is rather more elongated." I have not seen the holotype, described from C. R. Boettger's own collection. The original figure, copied in my Pl. 59, fig. 2, agrees well with some of the *zanzibarica* collected by Mr. A. Loveridge and Dr. F. X. Williams in Usambara and Uluguru.

Original description of *A. zanzibarica* var. *naegelei* C. R. Boettger (1913): "Differt a typo figura minore et graciliore et anfractibus rapidius accrescentibus; testa flava, flammulis brunneis ornata. Long. 78, diam. 38 mm.; apertura, alt. 39, lat. 20 mm. This variety differs from the type in being smaller and more slender, even than var. *lhotellerii* Bourg.; the whorls increase more rapidly than in the type. The shell is straw-yellow ornamented with chestnut stripes. The shape of the new form is quite different from that of the type of *A. zanzibarica* Bourg., and nobody, seeing only these two forms, would suppose that they belong to the same species. The variety *lhotellerii* Bourg., however, is intermediate between them. We now see that *A. zanzibarica* is a species, the shape of which varies from tumid ovate to slender ovate. All forms clearly show that they belong to one species by their upper whorls being intensely roseate, by being not very heavy, and by other features mentioned in Bourguignat's diagnosis." The description was based on a single specimen in C. R. Boettger's collection. I have not seen this type. The original figure, copied in my Pl. 1, fig. 2, can be duplicated among the individual variants of some of the lots of *zanzibarica* at M.C.Z., particularly those collected by Mr. A. Loveridge near Tanga. This latter lot shows all transitions from slender specimens (Pl. 4, fig. 2) to such with obese body-whorl (Pl. 37, fig. 3). The collections of the M.C.Z. contain also 2 shells from Kwirow, one 61 mm. long, of $6\frac{1}{3}$ whorls, the other 86 mm. long, of $7\frac{1}{2}$ whorls, which I cannot separate from some *zanzibarica* of about the same age.

Original description of *A. madaziniana* Clench and Archer (1930): "Shell acutely ovate, imperforate, rather thin but strong. Nuclear whorl pinkish buff. All following whorls as far as body-whorl having pinkish buff ground color. Beginning at second whorl from nuclear whorl and continuing to edge of aperture surface covered with rather straight, longitudinal, liver brown flames set apart at irregular intervals from each other, but tending to fuse together on the last fifth of the body-whorl. Ground color of body-whorl cinnamon buff. Nuclear whorl smooth, slightly flattened. Beginning at the second whorl from the nuclear whorl and continuing to the aperture, surface covered with axial striae at first light, but on the body-whorl becoming rather definite growth lines. These striae and growth lines are intersected over

most of the surface by spiral lines set apart at rather irregular distances. These lines are obsolescent on the lower half of body-whorl. From fourth whorl from apex to edge of aperture there is a series of rough subsutural folds. Whorls 7. Aperture acutely ovate. Interior translucent, showing the color pattern of exterior. Outer and basal margins very sharp. Columella long, almost straight and sharply truncate. Parietal wall almost completely lacking a callus. Alt. 87, diam. 44.5, ap. length 49.5, ap. width 23 mm. (holotype). Alt. 76, diam. 40.5, ap. length 43, ap. width 22 mm. (paratype)." Both types at the M.C.Z. are immature. After comparing them with specimens of *A. zanzibarica* of approximately the same age, that is of about the same number of whorls ($6\frac{1}{4}$ to $6\frac{1}{2}$), I am unable to find reliable differences and I am forced to include *madaziniana* also among the synonyms of that variable species. The holotype is shown from a new photograph in my Pl. 77, fig. 5. The Pleistocene shells referred by C. R. Boettger (1947) to *madaziniana* do not seem to have been true *zanzibarica*. The figure appears to be of an immature *A. fulica hamillei*, full-grown specimens of which were recorded from the same locality as *A. acuta*.

A. zanzibarica is a medium-sized, rather thin and light species, 80 to 135 mm. long when full-grown. Adult shell usually elongate-ovate, widest at about the lower third, with a short, narrow, regularly conical spire, as a rule sharply set off from the inflated body-whorl. Of the $6\frac{1}{2}$ to $7\frac{1}{2}$ whorls, those of the spire fairly closely coiled, very gradually increasing in width and length, moderately convex, separated by deeply impressed but narrow sutures. Apex obtusely pointed. Body-whorl over two-thirds, sometimes even up to three-fourths of the total length of the shell in front view, markedly more convex than the penultimate whorl. Aperture long and comparatively narrow, half or more of the total length of the shell, semi-elliptical, with evenly curved outer margin. Inside bluish-white, showing the darker outside markings through the translucent shell. Outer lip thin, sharp, often with a dark border within. Parietal wall covered with a very thin, bluish-white glaze. Columella bluish-white, long and narrow, usually straight or nearly so, more rarely slightly concave, sometimes weakly twisted or folded in the upper portion, obliquely truncate some distance from the base of the aperture. The sculpture of the very young shell is described in detail below. In the adult it is often nearly completely worn off on the early whorls, as far down as the fourth. The latter is finely decussated by numerous transverse engraved lines crossing the fine closely-set vertical growth-striae at fairly even intervals. This sculpture is coarser and less regular on the fifth and sixth whorls, consisting of vertical series of elongate welts. It gradually

becomes less pronounced on the body-whorl, being as a rule very superficial over the last half or third behind the outer lip, and is even weaker at and below the periphery, although traces of the welts persist even near the columella. In addition to this coarser sculpture, the periostracum of well preserved shells shows a microscopic "weave" pattern of impressed criss-cross lines. The growth-striae are coarser, more fold-like in the upper part of the body-whorl, where they are set off, as a rule, by an irregular, deeply impressed line, producing a slightly crenulate or bead-like subsutural area. Normally, the ground color is straw-yellow or brownish-yellow, sometimes with whitish-yellow patches; the summit is either roseate or dirty-white, both conditions seemingly occurring in apparently fresh shells of the same colony. The fourth whorl shows the first traces of dark markings, as pale brown, straight, slightly bent or wavy vertical streaks. These become gradually darker and bolder, mahogany to chocolate-brown, on the succeeding whorls, from the latter half of the fifth on. On the penultimate and body-whorl the streaks are often very broad, but irregular, jagged at the edges, broken up into patches or confluent. Two shells in a lot of otherwise normal ones, from Magrotto (Pl. 41, fig. 2), are nearly unicolorous pale straw-yellow, with a few darker yellow vertical lines and a milky-white apex, and are evidently albinos. In the same lot transitional stages of partly marked shells connect them with normally marked individuals. The lot from Iloilo also contains a unicolorous straw-yellow example.

The species is variable in outline, even among adult shells, which accounts for the several named varieties. All of these are here regarded as individual variants, since they are found in one locality if a sufficiently large series is available, and are also linked by transitions. An unusually slender and 2 more normally shaped shells, all from Magrotto, are shown in Pl. 4, fig. 2, Pl. 37, fig. 3, and Pl. 41, fig. 2.

A. zanzibarica is noteworthy for being one of the few Achatininae that are truly ovoviviparous.¹ Mr. A. Loveridge found at Amani three adults, one dead, the other two alive, containing respectively 55, 72, and 27 young snails considerably beyond the nepionic stage. These are brownish-ivory (without the roseate hue of the apex of their mothers), at first unicolorous, but marked beyond the third whorl, above the periphery, with vertical, slightly bent, light chestnut-brown streaks. They consist of $3\frac{1}{4}$ to $3\frac{1}{2}$ whorls and are 8.5 to 11.2

¹ G. H. Clapp (1897, *The Nautilus*, **11**, p. 69) reported finding three embryonic shells, about 8 mm. in diameter, in a dead example of *Archachatina crawfordi* (Morelet). G. C. Robson found rather advanced young snails in an undetermined *Limicolaria*, from S. W. Uganda (1912, *Proc. Mal. Soc. London*, **10**, pt. 1, p. 32), but was uncertain as to whether this was a case of true viviparity.

mm. long, 6.5 to 8.5 mm. wide, with the aperture 5.7 to 7.5 by 3.6 to 5 mm. The first $1\frac{1}{2}$ to 2 whorls, apparently formed in the egg, are smooth or with extremely fine vertical wrinkles. Spiral engraved lines, placed at irregular intervals, appear on the latter part of the second whorl, cutting across the growth-wrinkles. The decussation gradually grows stronger, being more distinct beyond the third whorl than on the corresponding area of full-grown snails. Another shell from Magrotto, 89 mm. long, was found estivating, the aperture closed with the customary brittle, calcareous, white epiphragm. It contained 9 young shells of the size and with the sculpture as described above. Unhatched eggs, taken from some live snails at Amani, are pale yellowish, ellipsoidal, 9.1 mm. long and 6.5 mm. wide.

Measurements of Adult Shells

Greatest		Aperture		Whorls	
Length	Width	Length	Width		
120 mm.	59	68	32	7¾	Ilo
116	61	67	34	7½	Mt. Rungwe
114	52	60.5	30.5	7½	Amani
108	57.5	62	30	7¼	Mt. Rungwe
105	51.5	57	27	7¼	Amani
103	52.5	60.5	27	7¼	Mt. Rungwe
101	51	53	27	7½	Amani
98	50	52	28	7⅕	"
96	46	49.5	25	7	"
94.5	47	49	25	7¼	"
94.5	46	52	25	7½	Magrotto
92	45	51	23.5	7	Amani
89	43	49	23.5	7	Magrotto
88	43	48.5	21.5	7⅓	Amani
86	43.5	47	23	7½	Kwiro
86	37.5	45.5	18.5	7½	Magrotto
85.5	41	46.5	21	7¼	Kizerui
82.5	39.5	47	21	7	Amani
81	43	41.5	23.5	6¾	Lutundi

Specimens Examined. KENYA COLONY: Mt. Mbololo, 4400 ft. (E. Heller; A. Loveridge.—U.S.N.M.; M.C.Z.). — TANGANYIKA TERRITORY: Amani, Usambara Mts., 3000 ft. (J. Vosseler; A. Loveridge; F. X. Williams.—M.C.Z.; Berl.M.); Kizerui, Usambara Mts., 4000 ft. (A. Loveridge.—M.C.Z.); Lutindi, Usambara Mts., 4000 ft. (A. Loveridge.—M.C.Z.); Nguelo, Usambara Mts., 2 probable paratypes of *usambarensis* (U.S.N.M.); Magrotto near Tanga (A. Loveridge.—M.C.Z.); Siga Caves near Tanga (A. Loveridge.—M.C.Z.); Vituri,

Uluguru Mts., 2500 ft. (A. Loveridge.-M.C.Z.); Nyange, Uluguru Mts., 3000 ft. (A. Loveridge.-M.C.Z.); Bagilo, Uluguru Mts., 5000 ft. (A. Loveridge.-M.C.Z.); Kwirow near Mahenge, type locality of *naegelei* (G. Naegle.-M.C.Z.); Ilolo, at the foot of Mt. Rungwe, 4600 ft. (A. Loveridge.-M.C.Z.); Mt. Rungwe (R. Boulton.-Ac.N.S.Phila.; Carn.M.; M.C.Z.); Madazini near Kilosa, holotype of *madaziniana* (A. Loveridge.-M.C.Z. No. 53185); Itende near Kilosa, paratype of *madaziniana* (A. Loveridge.-M.C.Z. No. 53186); Mikindani (A. Loveridge.-M.C.Z.); Mbanja Airfield near Lindi (A. Loveridge.-M.C.Z.).

Both *A. zanzibarica* and *A. lhotellerii* were described from Nasimoya (or Mnazi Mmoja), a suburban section of the City of Zanzibar. This original habitat needs to be confirmed. All recent records are from the opposite mainland in Kenya Colony and Tanganyika Territory, where the species appears to be widely distributed.

Ancey's figured example (1902, as *lhotellerii*) was 118 mm. long, 56.5 mm. wide, with the aperture 57.5 by 32.5 mm. This and the largest shells of the foregoing table are close to Bourguignat's type, which was 117 mm. long. The largest specimen recorded is one mentioned by v. Martens (1897), 134 mm. long, 62 mm. wide, with the aperture 71 mm. long.

An abnormal shell, apparently adult and shown in my Pl. 79, fig. 4, found at Amani with normal examples, is remarkable for the nearly total lack of truncation at the base of the columella. It is 81.5 mm. long, 43 mm. wide, of $6\frac{3}{4}$ whorls, with the aperture 45.5 by 24 mm.

ACHATINA (LISSACHATINA) ALLISA Reeve

Pl. 63, fig. 3

Achatina allisa Reeve, 1849 (February), Conch. Icon., **5**, *Achatina*, Pl. 5, fig. 15 (supposedly from "Cape Palmas, West Africa"). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 489. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 603. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 202. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 218. Paetel, 1869, Moll. Syst. Cat., p. 80; 1873, Cat. Conch.-Samml., p. 99. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 276. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 239. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 33; Pl. 35, fig. 17 (after Reeve). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 65.

Achatina (Achatinus) allisa Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 266. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 123.

Original description of *A. allisa* Reeve (1849): "Achat. testa elongato-oblonga, subcylindracea, anfractibus septem, oblique subtiliter granato-striatis, infra suturas tenue crenulatis, apertura parviuscula; columella arcuata, subcontorta, abrupte truncata; olivaceo-lutescente, maculis rufo-castaneis oblongis hic illic irregulariter inquinata. Shell elongately oblong, somewhat cylindrical, whorls seven in number, obliquely finely granosely striated, finely crenulated beneath the sutures, aperture rather small; columella arched, slightly twisted, abruptly truncated; olive-yellow, here and there irregularly bedaubed with reddish chesnut blotches. This species may be readily distinguished from any of those hitherto described, by its oblong cylindrical form and peculiar style of irregular blotching. The aperture is proportionably smaller and narrower than in the allied species." Reeve's figure, copied in my Pl. 63, fig. 3, is 77 mm. long, 33 mm. wide, with the aperture 36 by 18 mm. The type and only definitely known specimen, from the Cuming Collection, is now at the British Museum, where I saw it in 1933. Unfortunately I was not aware at the time of its possible relations to *A. iredalei* Preston, so that I failed to compare it with that species. The locality "Cape Palmas" is no doubt one of Cuming's many errors. No shell even remotely resembling *A. allisa* has been collected during the past century in West Africa. I am strongly inclined to regard it as an unusually slender example of the East African *A. iredalei*, although none of the many specimens which I have seen of that species matches Reeve's figure either in shape or in design. It seems scarcely possible that *allisa* might be *A. spekei* Dohrn, a species which I shall discuss more fully under *A. iredalei*. *A. capelloi* Furtado (= *A. morelli* Preston) is another species which may have to be considered in attempting to settle the identity of *A. allisa*.

ACHATINA (LISSACHATINA) DELORIOLI Bonnet

Pl. 4, fig. 4

Achatina deLorioli Bonnet, 1864, Rev. Mag. Zool., (2), **16**, p. 279 (supposedly from "Brazil", an erroneous locality); Pl. 22, figs. 1-1a (*Achatina lorioli* on Plate).

Cochlitoma delorioli Pilsbry, 1904, Man. of Conch., (2), **17**, p. 82; Pl. 28, fig. 41 (after Bonnet).

Achatina lorioli Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 218; 1876, *Op. cit.*, **8**, p. 276. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240.

Achatina (Achatinus) lorioli Pfeiffer, 1879, Nomencl. Helic. Viv., p. 266.

Original description of *A. deLorioli* Bonnet (1864) (translated from the French): "Shell thin, transparent, obtuse, marked with slightly

oblique striae, rather strong on the body-whorl; finer at the summit of spire, where they are crossed by other spiral striae also very little visible; the last 2 or 3 whorls covered with a rather dark fulvous periostracum, lighter at the summit and toward the umbilical region; spire of 7 slightly rounded whorls with slightly wavy sutures; body-whorl semi-globulose, marked with large, lengthened, irregular dark brown spots, which do not reach the ends of the whorls; sometimes these spots are decidedly oblique and disappear toward the summit of the spire. Aperture oval, with very thin margins, violaceous-white inside, but yellowish by transparence, the outside spots being well visible; columella whitish. Height, 72; width, 32 mm." On the original figure, copied in my Pl. 4, fig. 4, the aperture is 36 mm. long and 13 mm. wide. The present whereabouts of the type is unknown; but the locality "Brazil" was undoubtedly erroneous and the shell came most probably from East Africa. The species is here included because of its obvious relations to *A. iredalei* and possibly to *A. allisa*. Pfeiffer (1868) wrote from the figure that its shape was very similar to that of *A. vestita*, from Natal, but that it differed in the much less obtuse spire and the simple suture. Pfeiffer's remarks may have induced Pilsbry to place *delorioli* in *Cochlitoma* and to suggest that the draughtsman may have made the apex too narrow. However, the figure agrees well with some of the more slender examples of *A. iredalei* I have seen, while the pattern shown is often found in that species. Nevertheless, it would seem unwise to adopt the name *delorioli* for *A. iredalei*, until something definite can be known of the type and until the identity of *A. allisa* can also be settled.

ACHATINA (LISSACHATINA) IREDALEI Preston

Pl. 13, fig. 3; Pl. 14, fig. 3; Pl. 57, fig. 2; Pl. 60, fig. 2;
Pl. 61, figs. 3-4; Pl. 64, fig. 2; Pl. 65, fig. 3; Pl. 77, fig. 2

Achatina iredalei Preston, 1910, Ann. Mag. Nat. Hist., (8), **6**, p. 533; Pl. 9, fig. 20 (Kenya Colony: Shimbi [=Shimba] Hills, [15 to 20 miles N. of Mombasa]). Germain, 1920, Voy. Afr. Orient. Angl. 1912-1913 G. Babault, p. 245 (in Expl. of Plates); Pl. 2, figs. 1-2 (2 colored views of paratype).

Achatina allisa Pfeiffer, 1865, Syst. Conch.-Cab., **1**, Abt. 13, pt. 1, p. 367; Pl. 44, figs. 7-8 (2 views of a shell from Zanzibar Id.). Gibbons, 1879, Jl. of Conch., **2**, p. 143 (Zanzibar Id.: a dead shell, doubtfully referred to this species from a cave on an islet between Bawri Id. and Chapani). (?) G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 145 (doubtful identification of a shell from "Africa"). Not of Reeve, 1849.

Achatina allisa var. β Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 489 (with de-

scription of a shell from Zanzibar Id.; also a reference to Pl. 44, figs. 7-8 of Syst. Conch.-Cab., which was as yet unpublished). v. Martens, 1897, Deutsch-Ost-Afrika, 4, Beschalte Weichth., p. 92; 1897, Arch. f. Naturgesch., 63, pt. 1, p. 54.

Achatina (Achatinus) allisa var. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 266.

Original description of *A. iredalei* Preston (1910): "Shell ovately fusiform, moderately solid, the earlier whorls pink, the latter covered with a brownish periostracum, and painted with broad, irregular, somewhat distant and occasionally much broken, transverse chestnut bands and flame-markings; whorls 7, regularly increasing, rather flattened, decussately sculptured, the sculpture becoming obsolete towards the base; sutures impressed, crenellate and narrowly margined below; columella bluish-white, a very thin callus joining it with the sutural region just inside the aperture, slightly excavated, descending nearly vertically; labrum simple, acute; aperture rather narrowly, elongately ovate, interior of shell bluish-white. Alt. 101, diam. 41 mm. Aperture: alt. 48, diam. 29 mm." The large specimen shown in Preston's original figure, copied in my Pl. 14, fig. 3, may be taken as the holotype. It is now at the British Museum, where I saw it in 1933. I have also seen paratypes, from the original lot, in several collections, one being at the M.C.Z. There is no difficulty about recognizing this species.

The bleached shell which Pfeiffer (1853) described and later figured as a variety of *allisa* and the shell which Gibbons (1879) referred doubtfully to that species, both came from the Island of Zanzibar. I consider that they were *A. iredalei*, which is common on that island. I also list here doubtfully the specimen which G. Nevill (1879) called *A. allisa*.

A. iredalei is one of the smaller species of the genus, averaging about 80 mm. in length when full-grown. Shell often fairly thick and heavy, very regularly elongate-ovate, sometimes almost spindle-shaped, widest at or slightly below mid-length, with a short, broad, regularly conical spire, the cone continuous with the upper part of the body-whorl. All of the $6\frac{3}{4}$ to $7\frac{1}{3}$ whorls moderately and about equally convex, the body-whorl not much more so than the whorls of the spire, except in unusually broad and short examples; all whorls separated by slightly impressed sutures. Apex obtusely pointed; upper 3 or 4 whorls somewhat more closely coiled; the others gradually increasing in width and length. Body-whorl about three-fourths of the total length of the shell in front view. Aperture long and comparatively narrow, about half of the total length of the shell or slightly more, semi-elliptical, with very evenly curved outer lip. Inside pure white

or slightly bluish. Outer lip normally thin, sharp, white along inner margin. Parietal wall with a mere trace of a bluish-white glaze. Columella pure white or faintly bluish, long and narrow, very weakly concave or nearly straight, obliquely truncate some distance from the base. First $1\frac{1}{2}$ to 2 (nepionic) whorls, as studied on young shells hatched in the uterus (see below), entirely smooth; next early whorl at first with superficial vertical wrinkles only; beginning with the latter part of the third whorl, the wrinkles become closely-set growth-striae, and fine, spiral engraved lines appear. Decussation well-marked from the fifth whorl on, consisting then of vertically elongate granulation; as a rule best developed on the upper half of the body-whorl (7th), and consisting here of very long, unequal, vertical welts, placed in irregular vertical and spiral rows; the welts often bifid, either at the upper or at the lower ends. Growth-striae coarser below the sutures, producing a fine, irregularly crenulated sutural line; sub-sutural area often set off by a transverse depression or line. Below the periphery of the body-whorl, decussation much weaker in most shells, often almost wanting, although the growth-striae are well marked down to the base and the columella. In some examples the decussation of the body-whorl almost as strong below as above the periphery, although such shells do not otherwise differ from more normal ones in the same colony. Periostracum, when well preserved, showing in addition to the decussation at least traces of a "weave" type, criss-cross microsculpture, usually best seen on the lower half of the whorls. This microsculpture is present in the paratype at M.C.Z. Ground color deep straw-yellow to golden-yellow, with a very variable pattern of dark chestnut or mahogany-brown, vertical markings. In a few shells, streaks complete or nearly complete from suture to suture and, on the body-whorl, from suture to base, but of unequal width and more or less jagged at the edges. More often streaks incomplete or broken up into spots or blotches, usually stopping rather abruptly at the periphery. The number and size of the markings vary to such an extent that scarcely two shells are alike. Some examples have only traces of them and a few from Siga Caves and Kibarini are unicolorous brownish-yellow. Summit of the shell as a rule intensely roseate; sometimes dirty-white even in the same lot with pink-tipped shells (possibly faded in life).

A shell from Zanzibar Id., collected alive by Dr. F. X. Williams, is unusual in having the outer lip much thickened, evidently through old-age accretions to the inner margin; these deposits of lime have nearly obliterated the columellar truncation. The shell is fully adult, of $6\frac{3}{4}$ whorls, but only 68 mm. long and 34.5 mm. wide (Pl. 77, fig. 2).

Like *A. zanzibarica*, *A. iredalei* appears to be ovoviviparous. At any

rate, an adult shell, found dead by Mr. A. Loveridge at Ngatana, contained several young shells, larger and of more whorls than at the nepionic stage. They are 9 to 9.5 mm. long, of about $3\frac{1}{2}$ whorls. They showed conclusively that the nepionic shell of this species is perfectly smooth (Pl. 65, fig. 3).

A. iredalei is sometimes labelled in collections *A. allisa* Reeve. As noted before, *iredalei* may eventually be shown to be a synonym either of *A. allisa* or of *A. delorioli*, or perhaps of both; but this cannot at present be proved conclusively. I prefer therefore to use a name about the identity of which there can be no doubt, particularly in view of the fact that it is one of the few species now well-known anatomically. I have also seen *A. iredalei* under the name *A. albopieta*, a species which had not been properly recognized thus far. *A. iredalei* is closely related to *A. zanzibarica* Bourguignat. Although these two species are distinct enough when full-grown, they are often puzzling when immature, particularly as both sometimes occur in the same locality. The much narrowed and drawn-out summit of the spire of *zanzibarica* is then its most reliable distinguishing feature.

A. iredalei might perhaps be confused also with *A. spekei* Dohrn (1864, Proc. Zool. Soc. London, p. 117), described from East Africa, "near Lake Victoria"; but the type and immature paratype, at the British Museum, are labelled "East Africa, from the Central Plateau, 6° S. lat.", which places the type locality in Tanganyika Territory. The types are figured here for the first time in Pl. 81, figs. 2 and 3. I studied them at the British Museum in 1933 and concluded that they were conspecific with *A. thomsoni* E. A. Smith (1880, Ann. Mag. Nat. Hist., (5), 6, p. 428; 1881, Proc. Zool. Soc. London, p. 283; Pl. 33, fig. 12), the type of which I also compared, and which then becomes a synonym. Smith's original figure of *thomsoni* is copied in my Pl. 62, fig. 3; his type locality was also vaguely given as "between Lake Nyasa and the East Coast," which could be in Tanganyika Territory, Nyasaland or Portuguese East Africa. Specimens from the Chirinda Forest, Southern Rhodesia (M.C.Z.), which I refer to *A. spekei*, differ decidedly from *A. iredalei* in being regularly spindle-shaped, with the upper (subsutural) portion of the body-whorl rather flattened, as well as in the slightly different sculpture and the relatively shorter spire.

Specimens Examined. KENYA COLONY: Shimba Hills near Mombasa, holotype (Brit.M.) and paratypes (M.C.Z.; Brit.M.; Terv.M.; Frankf.M.; Leid.M.; U.S.N.M.); Gedi Ruins, 10 miles S. of Malindi (F. X. Williams.-U.S.N.M.; M.C.Z.); Witu (A. Loveridge.-M.C.Z.); Ngatana on Tana River (A. Loveridge.-M.C.Z.); Diani Beach, P. O. Ukunda, S. of Mombasa (F. X. Williams.-M.C.Z.; U.S.N.M.); Ma-

lindi (F. X. Williams.-M.C.Z.); Kibarini Experiment Station, near Kilifi (F. X. Williams.-U.S.N.M.; M.C.Z.). — TANGANYIKA TERRITORY: Siga Caves near Tanga (A. Loveridge.-M.C.Z.); Songo-Songo Id., in the Mafia Group (A. Voeltzkow.-Berl.M.; Frankf.M.; M.C.Z.); Ibondo Id., in the Mafia Group (O. Baumann.-Brit.M.; M.C.Z.). — ZANZIBAR ID.: Kizimbani (F. X. Williams.-M.C.Z.); Chwaka Bay (F. X. Williams.-U.S.N.M.; M.C.Z.). — PEMBA ID.: (A. Voeltzkow.-Berl.M.).

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Length		
92 mm.	38.5	45	21	7½		Pemba
90	44	45.5	24	7		Ngatana
87	43.5	50	24.5	7		Diani Beach
86	43	46.5	22.5	7¼		Shimba, paratype
84	40	39.5	23	7½		Ngatana
83	40	42	22	7		Diani Beach
81.5	40.5	45.5	22.5	7		Witu
80.5	41	44	21	7		Shimba, paratype
77.5	35	37	19	7		Siga Caves
77	37	41.5	20	6½		Ngatana
76.5	38	42	21.5	7		Diani Beach
74.5	36.5	39	21	7		Zanzibar Id.
73	34	37	18	7		Siga Caves
72	36.5	38	19.5	7		Zanzibar Id.
71	31.5	37.5	15.5	6½		Songo Songo
70.5	33	34.5	17.5	6½		Diani Beach
69	35.5	34.5	19.5	7		Siga Caves
68	33.5	33	17.5	6¾		Zanzibar Id.
66.5	29	33.5	14.5	6½		Songo Songo
64	32	34	17	6¾		Diani Beach

The holotype is slightly larger (101 mm.) than any specimen I have measured. The paratype figured by Germain (1920) is about average, 80 mm. long, 37.5 mm. wide, with the aperture 44 by 20.5 mm.

ACHATINA (LISSACHATINA) ALBOPICTA E. A. Smith

Pl. 5, fig. 4; Pl. 12, fig. 3; Pl. 21, figs. 1 and 3; Pl. 24, fig. 4; Pl. 27, fig. 1; Pl. 40, fig. 2; Pl. 42, fig. 2; Pl. 43, fig. 2; Pl. 52, fig. 2; Pl. 58, fig. 2; Pl. 63, fig. 2; Pl. 65, fig. 1; Pl. 66, fig. 2; Pl. 67, fig. 3; Pl. 81, fig. 6

Achatina albopicta E. A. Smith, 1878, Quart. Jl. Conch., 1, pt. 15, p. 346 (no locality; "probably African"). Kobelt, 1879, Synopsis Moll. Viv. Test.

- 1878 Promulgat., p. 89. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 239. Ancey, 1902, Jl. de Conchyl., **50**, p. 278, fig. on p. 279 (no locality; fig. of a specimen, not the type).
- Cochlitoma albopicta* Pilsbry, 1904, Man. of Conch., (2), **17**, p. 88; Pl. 13, fig. 43 (after Ancey). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66.
- Achatina albopicta* var. *β subunicolor* Ancey, 1902, Jl. de Conchyl., **50**, p. 279 (no locality; with brief description).
- Achatina pilsbryi* d'Ailly, 1910, in Sjöstedt, Kilimandjaro Meru Exped., **1**, Abt. 6, p. 20; Pl. 1, figs. 27-30 (Tanganyika Territory: at the Mkulumusi Caves near Tanga, Usambara).

Original description of *A. albopicta* E. A. Smith (1878): "Shell rather solid and heavy, ovate, acuminate above or in the direction of the apex. The colors are about equally divided, and consequently the ground color may be termed either white or dark-brown; in the former case it would be streaked and blotched with brown and in the latter with white. The streaking and blotching are very irregular, but decidedly display a tendency for an oblique direction parallel with the lines of growth. Whorls $7\frac{1}{2}$, rather convex, and ornamented over the entire surface with narrow, elongate granules, which like the coloring also follow the direction of the incremental lines or striae. The last whorl is not very ventricose, but extends or is produced some distance below the truncated end of the columella. The aperture is about as long as half the entire length of the shell, of an irregular, elongate, oval form, acute superiorly, very white within, being covered with a thick shelly deposit of that hue. The columella is only slightly arched, also clothed with a white callosity extending upwards over the whorl as far as the extremity of the outer lip. Its truncation is rather abrupt and narrow. The nearest ally of this species appears to be *A. kraussi* Rve. It differs from it, however, in having a more elongate and acuminate spire, the more varied and irregular character of the blotching and the strongly marked granular sculpture." This description is preceded by a Latin diagnosis, which appears to be a condensed version of the English text, hence is not copied here. The dimensions are given as "Long. 84 mill.; diam. 37; apert. long. 43; diam. 22." Ancey (1902) gave a few additional notes on this species (translated from the French): "Recently (October, 1901) I had occasion to examine the type at the British Museum, and I have noticed that the specimen described must have lost the periostracum, so that the name which Smith gave scarcely fits fresh specimens, in which the ground color is not white, but a rather dull yellow. The shell, moreover, has little gloss. The species is well recognizable by the convexity of the whorls, notably near the suture. I figure a specimen of the typical form. I

have a second specimen, which may be a variety *β subunicolor*, with the shell almost entirely yellow with a few designs or macules, especially on the upper whorls." The specimen figured by Ancey, presumably natural size, is smaller than Smith's type, being 66 mm. long, 34 mm. wide, with the aperture 34 by 18.5 mm. It is evidently immature, consisting of about 6 whorls. I examined Smith's type at the British Museum in 1933. It is figured here for the first time (Pl. S1, fig. 6). It is somewhat worn, but shows nevertheless clearly the outstanding characteristic of the species, the sculpture consisting of coarse elongate granules or welts which cover the entire surface, as noted by Smith. They extend on the body-whorl of the adult below the periphery to the base of the shell, a peculiarity which this species shares only with *A. reticulata*. Neither Smith nor Ancey knew the locality of their specimens.

Original description of *A. pilsbryi* d'Ailly (1910): "Testa conico-ovata, solidula, sericeo-nitidula, summum versus saturate rosacea, apice mamillato, anfractus embryonales unicolores, sequentes duo fasciis rufescentibus, angustis, aequidistantibus, oblique ad sinistram abeuntibus vel flexuosis, superne rarissime bifurcatis ornati, ceteri sub periostraco pallido olivaceo, in ultimo saturatiore, albescentes, strigis flammulisque fusco-castaneis, in peripheria latioribus plerumque fulguratis interdum in maculas dissolutis picta; spira regulariter conico; anfr. 7 convexiusculi, regulariter accrescentes, ultimus basi attenuatus; sutura impressa, inter anfractus quatuor ultimos rugoso-plicata lineaque fortiter impressa marginata; anfr. embryonales laevigati, sequentes leviter plicato-striatis, ultimi tres fortiter plicis incrementalibus ad suturam validioribus et lineis impressis spiralibus in ultimo sat distantibus et infra peripheriam infirmioribus, plicas incrementi in rectangula superne saepe bipartita in parte superiore anfractuum pervalida praesertimque ibi longitudinaliter inter se non regulariter continuata, transformantibus, praeterea superficies tota, summo excepto, oculo nudo haud conspicue regulariter densissimeque decussatim cancellata. Apertura parum obliqua, acuminato-oblonga, dimidium longitudinis testae paulum superans, intus lacteo-caerulea, flammulis externis translucetibus; peristoma simplex, acutum, intus fusco-castaneo-limbato, marginibus callo eburneo extus distincte terminato picturam parietis pellucide exhibente junctis, margine externo regulariter curvato; columella stricta, sursum vix tortuosa, abrupte truncata, basin aperturae non attingens, callo porcellaneo, sursum in pariete aperturali dilatato, incrassata. Long. 74, diam. 39; apert. long. $40\frac{1}{2}$, lat. $20\frac{1}{2}$ mm." I saw the holotype and two paratypes at the Stockholm Museum in 1933. As d'Ailly suspected, they are immature shells. The species has not been mentioned since it was

described. As listed above, it is a synonym of *A. albopicta*. The original figure of the type in front view is copied in my Pl. 63, fig. 2.

A. albopicta appears to have been generally overlooked or confused with other East African species, owing to the extraordinary variation in shape and the wide range of size. Immature examples may be mistaken for young or slender *A. zanzibarica* or *A. iredalei*, or possibly even *A. craveni* E. A. Smith. On the other hand, very large, full-grown specimens could readily be regarded as slender or dwarfed *A. reticulata*, to which species *A. albopicta* is no doubt most closely related. Fortunately Dr. F. X. Williams collected several hundred examples in one locality, ranging all the way from newly hatched to adult and even giant, old shells. Without the transitional stages, it might have been very difficult, if not impossible, to recognize all of these shells as belonging to one species. For this reason I have figured a selected series of stages of growth, from the nepionic shell to one of the largest adults seen. The latter (Pl. 27, fig. 1), 166 mm. long, had to be slightly reduced to fit in the format of this Bulletin. Moreover, Dr. Williams also sent us some live snails of both *A. albopicta* and *A. reticulata*. Their dissection disclosed to Dr. A. Mead significant anatomical differences, removing all doubts as to their specific distinctness.

When full-grown, *A. albopicta* averages about 130 mm. in length for $8\frac{1}{2}$ whorls, but may exceptionally reach 176 mm. for as many as 10 whorls (the apical ones in this case almost always lost). Adult shell thick, opaque, solid, but moderately heavy, elongate-oval, with the greatest width at the lower third. Upper third, or spire, forming a regular, usually very slender cone, with strongly convex whorls (the later ones more so than those at the apex), separated by deeply impressed sutures. Early whorls when preserved forming a bluntly pointed apex, often broken off in large or old examples. Body-whorl sharply set off from the spire, about two-thirds of the total length of the shell, evenly but very strongly convex. Aperture relatively short and broad, much less than half and often only one-third of the total length of the shell, semi-elliptical, with strongly but evenly curved outer margin. Inside white. Outer lip simple, moderately thick, usually sharp at the edge. Parietal wall with a distinct white callus. Columella long, thick, white, moderately concave, strongly truncate close to the base. In older shells, first 3 to $4\frac{1}{2}$ whorls smooth or worn smooth (original sculpture described below); succeeding whorls decussate. Closely-set, strong vertical growth-wrinkles are cut at fairly regular intervals by deep spiral engraved lines or grooves, visible to the naked eye from the sixth whorl on; this produces regular vertical and spiral rows of elongate welts, usually simple, rarely bifid; they are

much stronger and fold-like below the sutures. Sculpture strongest on the body-whorl, where it extends equally over the entire surface from suture to base. It is of the same type as that of *A. reticulata*, but slightly weaker and the welts lack the puckering visible in that species. In most adult shells periostracum almost completely worn off; if preserved, with the criss-cross or "weave" microsculpture of younger shells. Apical 3 whorls, when present, pale roseate; light brown vertical streaks appear on the latter half of the third whorl and continue darker over the fourth. Remainder of shell variegated white and mahogany-brown, the white areas being more yellowish when the periostracum is preserved. The dark pattern is extremely variable, sometimes of fairly complete, straight or wavy, narrow or broad, vertical streaks, more often jagged at the edges or broken up into transverse or anastomosing blotches, or even into small spots.

A. albopicta is oviparous. Dr. F. X. Williams found at Diani Beach a snail 130 mm. long, which had deposited 330 eggs in one set. Reproduction starts even before the snail is half-grown; one shell, 71 mm. long, of 7 whorls, found dead, contained some well-developed eggs. A few eggs were laid by the imported live specimens observed in captivity at Cambridge (M.C.Z.). The egg is regularly ellipsoid, 6.3 to 6.8 mm. long and 4.6 to 5.2 mm. wide, light saffron-yellow when freshly laid. The newly hatched, embryonic (or nepionic) shell (Pl. 21, fig. 3) is about 5.2 mm. long and 4 mm. wide, of $2\frac{1}{2}$ whorls, which are completely smooth and colorless. Sculpture appears on the latter half of the first post-nepionic whorl (beginning of fourth whorl of the shell), at first as weak vertical wrinkles, most pronounced below the sutures and gradually increasing in strength. On the fifth whorl appear a few weak spiral engraved lines, which gradually increase in numbers and strength, the decussation being distinct from the sixth whorl on. In young shells the nepionic shell and first post-nepionic whorl are shiny, the succeeding whorls dull, owing to the criss-cross or weave-type ("cancellate") microsculpture of the periostracum. The apex, at first colorless, gradually turns horn-color and eventually roseate (on shells 50 to 60 mm. long and over).

Although fully adult *A. albopicta* average smaller than *A. reticulata* of the same age and the same number of whorls, some shells of both species are about the same size. *A. albopicta* is, however, more slender and lighter, usually with more convex whorls; the coarse sculpture, although of the same type, is finer and more regular, and lacks the peculiar puckering which covers the welts in *reticulata*.

A. albopicta seems to be particularly prone to produce scalariform or subscalariform abnormalities, which emphasize the convexity of the whorls (Pl. 24, fig. 4). The deformity usually starts abruptly on the

fourth, fifth or sixth whorl, probably due to some injury. The new growth begins suddenly some distance below the suture of the foregoing area and some distance inside the aperture, thus producing at the suture a deep niche with a wide triangular opening. In most cases the new abnormal whorls are merely more strongly convex, with very deep sutures; in one shell they are in addition strongly shouldered below the suture, which is deeply and narrowly grooved. Of seven such abnormal shells seen, the largest is 96 mm. long, of 7 whorls; the smallest, 61 mm., of 6 whorls.

Specimens Examined. KENYA COLONY: Diani Beach, P. O. Ukunda, south of Mombasa (F. X. Williams.-M.C.Z.; U.S.N.M.); Tiwi Beach, 4 miles N. of Diani Beach (F. X. Williams.-M.C.Z.; U.S.N.M.); Malindi (A. Loveridge.-M.C.Z.). — TANGANYIKA TERRITORY: Siga Caves near Tanga (A. Loveridge.-M.C.Z.).

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
176 mm.	81	77	43	10		Diani Beach
168	80	73	43	10	" "	
166	70.5	76.5	37	9 $\frac{1}{3}$	" "	
166	70.5	74	39	9 $\frac{1}{2}$	" "	
155	66	70	39	9 $\frac{1}{3}$	" "	
147	67	73.5	37	9		Tiwi Beach
145	70.5	68	38	8 $\frac{1}{2}$		Diani Beach
141	65	68	34	8 $\frac{1}{2}$		Malindi
141	62.5	67	34	9		Tiwi Beach
132.5	60	61	34	8 $\frac{1}{2}$		Diani Beach
129.5	56	59	32.5	8 $\frac{1}{3}$	" "	
120	51.5	54	28	8 $\frac{1}{2}$	" "	
118	55	60	31	8 $\frac{1}{3}$	" "	
116	51	55	28	8	" "	
113	50	52.5	29	7 $\frac{3}{4}$		Siga Caves
110	51	51	28.5	8		Diani Beach
104	47	50.5	26.5	8	" "	
97	44	43.5	26	7 $\frac{3}{4}$	" "	

ACHATINA (LISSACHATINA) RETICULATA Pfeiffer

Pl. 9, fig. 4; Pl. 16, fig. 2; Pl. 63, fig. 4;

Pl. 66, fig. 1; Pl. 67, fig. 1; Pl. 71, fig. 4

Achatina reticulata Pfeiffer, 1845 (October), Proc. Zool. Soc. London, (for 1845), p. 74 (Africa); 1848, Monogr. Helic. Viv., 2, p. 252. Reeve, 1849, Conch. Icon., 5, *Achatina*, Pl. 2, fig. 9 (type, from Cuming Collection).

Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 160, and Expl. of Plates, p. 19 (Africa); Atlas, Pl. 129 (2 views of one shell. Plate published without name by Deshayes after Férussac's death, presumably in 1851). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 487. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Dunker, 1857, in Pfeiffer, Novit. Conch., **1**, p. 98 (first definite record from Id. of Zanzibar). Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 603; 1860, Syst. Conch.-Cab., **1**, Abt. 13, pt. 1, p. 326; Pl. 27, fig. 1 (specimen from Zanzibar, not the type). v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 202. A. D. Brown, 1861, Cat. Shells Coll., p. 56. Bielz, 1865, Verzeichn. Moll. Conch.-Samml., 3d Ed., p. 23. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 217. Haines, 1868, Cat. Terr. Shells Coll., p. 68. Paetel, 1869, Moll. Syst. Cat., p. 80; 1873, Cat. Conch.-Samml., p. 99. Fridrici, 1874, Bull. Soc. Hist. Nat. Metz, **13**, p. 184. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 275. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 53. G. R. Batalha, 1878, Cat. Coll. Conchyl. F. R. Batalha, p. 1. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 145. Gibbons, 1879, Jl. of Conch., **2**, p. 143 (Tanganyika Territory: Lindi Bay). Kobelt, 1880, Illustriertes Conchylienbuch, **2**, p. 262. Grasset, 1884, Index Test. Viv. Coll., p. 199. Ancey, 1885, Bull. Soc. Mal. France, **2**, p. 139 (Tanganyika Territory: Lindi River, dextral shells and one sinistral). Rethaan Macaré, 1888, Cat. Coll. Coq. Mme. Rethaan Macaré, p. 23. Martorell y Peña, 1888, Catálogo Colección Conch. Museo Martorell, Barcelona, p. 56. Bourguignat, 1889, Moll. Afr. Equat., p. 79. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240. v. Martens, 1897, Deutsch-Ost-Afrika, **4**, Beschalte Weichth., p. 81 (Id. of Zanzibar: Jambiani); 1897, Arch. f. Naturgesch., **63**, pt. 1, p. 54. Boucard, 1901, Cat. Coll. Coq. Terr., p. 49. Pilsbry, 1904, Man. of Conch., (2), **17**, p. 34; Pl. 35, fig. 15 (after Pfeiffer, 1860). Ancey, 1906, Bull. Scient. France Belgique, **40**, p. 190 (sinistral). Julia E. Rogers, 1908, The Shell Book, p. 275. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66. Dautzenberg, 1914, Bull. Soc. Zool. France, **39**, p. 57 (sinistral). Coen, 1945, Catalogo Gasteropodi Polmonati Coll. Coen, p. 42.

Achatina (*Archachatina*) *reticulata* Albers, 1850, Die Heliceen, pp. 190 and 192 (first more definite locality as "Coast of East Africa").

Achatina (*Achatinus*) *reticulata* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 123.

Original description of *Achatina reticulata* Pfeiffer (1845): "Achat. testa oblongo-acuta, solida, ponderosa, longitudinaliter confertim plicata, sulcis concentricis profunde reticulata, albida, castaneo-marmorata et maculata; spira elongata, acuta, superne minute granulata; sutura subcrenulata; anfractibus 8 parum convexis, ultimo 3/7 longitudinis subaequante; columella crassa, alba, arcuata, abrupte truncata; apertura utrinque attenuata, oblongo-ovali. Long. 160, diam. 70 mill." The type, from the Cuming Collection, figured by

Reeve (1849), should be at the British Museum, although I did not see it there in 1933. Fortunately the species is easily recognized, particularly from the original figure (copied in my Pl. 67, fig. 1), which is slightly smaller than Pfeiffer's measurements, being only 155 mm. long, 68 mm. wide, with the aperture 70 by 35 mm.; but the earliest whorls appear to be lost. The shell figured later (1860) by Pfeiffer was somewhat larger, being 167 mm. long, 73 mm. wide, with the aperture 80 by 41 mm. Both were exceeded by Deshayes' example (1851), which was 188 mm. long, 83 mm. wide, with the aperture 90 by 45 mm.

A. reticulata, the most handsome of the Achatinidae, is the second largest of the living land snails. It exceeds slightly *A. achatina* in total length, but is less bulky, the body-whorl being comparatively narrow. Adult shell of 8 to nearly 10 whorls, averaging about 160 mm. in length and 75 mm. in greatest width, very elongate oval, with the greatest width at the lower third, the upper two-thirds forming a regular, slender cone which includes both the spire and the upper portion of the body-whorl. Shell thick, opaque, solid, and rather heavy. Spire with moderately convex whorls and narrowly impressed sutures; early whorls forming a bluntly pointed apex when preserved, usually broken off in the adult. Body-whorl occupying about two-thirds of the total length of the shell, very evenly convex and only slightly more so than penultimate whorl. Aperture long and moderately wide, usually much less than half the total length of the shell, semi-elliptical, with very evenly curved outer margin. Inside white with a slight bluish tinge. Outer lip simple, thick or very thick. Parietal wall with a thick porcellaneous, white deposit. Columella long, thick, white, as a rule moderately concave, sometimes nearly straight, strongly truncate close to the base of the aperture. Nepionic $2\frac{1}{3}$ whorls (Pl. 71, fig. 4) smooth; next appear fine vertical growth-wrinkles, cut by a few superficial spiral engraved lines; from the fourth whorl on, the decussation is well-marked and is coarse and visible to the naked eye from the sixth on. On the body-whorl it is extremely rough and covers the entire surface fairly uniformly from suture to base; it consists of vertical welts, unequal in length, either simple or bifurcate, in regular, closely-set spiral rows, separated by deeply cut spiral lines at irregular intervals; in addition the welts show a fine, moderately deep, but dense puckering or puncturation visible only with a handlens. On the early whorls this microsculpture is also present, but more like impressed "weave" of cloth and is usually worn off in part. Growth-folds coarser below the sutures and set off there by a deep impressed line on the body-whorl and part of the penultimate whorl. *A. reticulata* is the most coarsely sculptured of all the Achatinidae. Nepionic and first post-

nepionic whorls dirty-yellowish, sometimes with a slight roseate tinge; remainder of shell with white or yellowish-white ground color and bold mahogany-brown to reddish-brown vertical markings; on the first post-nepionic whorls they are broad, straight or wavy streaks; from the fifth whorl on they are more irregular, either narrow or broad streaks or very deeply jagged at the edges or resolved into many, irregularly scattered, transverse blotches or small spots. The perios-tracum is completely lost in adult shells; in younger examples it is pale yellowish to golden-yellow and very thin.

A. reticulata is oviparous. Some eggs were deposited by live snails shipped from Zanzibar and kept at the M.C.Z. in Cambridge during the summer of 1948. At first they were pale saffron-yellow, but this color faded rapidly to a dirty yellowish-white. They are broadly and regularly ellipsoid in shape, 8 to 9 mm. long and 6.5 to 7.5 mm. in diameter.

Specimens Examined. Several without precise locality (Leid.M.; U.S.N.M.; Terv.M.; Ac.N.S.Phila.; A.M.N.H.).—ZANZIBAR Id.: without more precise locality (M.C.Z.; Ac.N.S.Phila.; A.M.N.H.; Amst.M.; Brus.M.; Brit.M.); Jambiani (Berl.M.); Chwaka Bay (F. X. Williams.—M.C.Z.; U.S.N.M.), abundant in the coral-limestone area of the East Coast of the Island.—TANGANYIKA TERRITORY: Mbanja Airfield near Lindi (A. Loveridge.—M.C.Z.).

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
208 mm.	94	98.5	52	9 $\frac{2}{3}$	Mbanja	
198	87.5	89	47.5	9 $\frac{1}{3}$	"	
192	83	90	42	9 $\frac{1}{2}$	Chwaka Bay	
188	80	81	41	9 $\frac{1}{2}$	"	
183	83	92	43	9 $\frac{1}{2}$	Mbanja	
180	75	82.5	42	9	"	
176	80	81	40	8 $\frac{1}{3}$	Chwaka Bay	
172	73	76.5	38	8 $\frac{1}{2}$	"	
170	83	87	40	8 $\frac{1}{2}$	"	
167	81	77	42	8 $\frac{1}{2}$	"	
161	74	79.5	35	8 $\frac{1}{2}$	"	
155	66	70	35	8 $\frac{1}{2}$	"	
155	73	75	38	8 $\frac{1}{2}$	"	
155	66.5	71	33.5	8	Jambiani	
147	71	74	38	8 $\frac{1}{2}$	Chwaka Bay	
143	60	67	31	8 $\frac{1}{2}$	"	
138	64	68	33	8	"	
131	60	61	30	8	"	
128	60	61.5	32	8	"	

An abnormal umbilicate example from Chwaka Bay is shown in my Pl. 63, fig. 4.

5. Subgenus *EUAETHIOPINA*, new name

Euaethiops Clench and Archer, 1930, Occas. Papers Boston Soc. Nat. Hist., 5, p. 295. Monotypic for *Euaethiops loveridgei* Clench and Archer, 1930. Not of Hampson, 1926.

Shell elongate-oval, with high spire. Aperture less than half the height of the shell, narrowed above in the full-grown shell, the upper part of the body-whorl being flattened, extended forward and descending behind the outer lip. Peristome fairly thick and slightly flaring below, very oblique in profile. Columella only weakly truncate at base. Summit narrowly but bluntly conical. Nepionic whorls not granulose, smooth or with very weak vertical wrinkles. The anatomy, originally described by Clench and Archer and recently revised by Dr. A. Mead, shows no essential departure from that of *Achatina*, proper.

Subgenotype: *Euaethiops loveridgei* Clench and Archer, 1930. No other species is known. *Euaethiops obtusa* Connolly, 1931, Ann. Mag. Nat. Hist., (10), 8, p. 314 (Uganda: Mt. Elgon, in North Bugishu District, 7,000 to 9,000 ft.), Pl. 12, figs. 10 (type) and 11-12 (paratypes), is a species of *Archachatina* of my new subgenus *Tholachatina*.

The holotype of *Achatina* (*Euaethiopina*) *loveridgei* (Clench and Archer) is shown in my Pl. 3, fig. 2.

6. Subgenus *LEPTOCALINA* Bequaert and Clench

Leptocala sect. *Leptocalina* Bequaert and Clench, 1934, Rev. Zool. Bot. Afric., 26, pt. 1, p. 117 (for *Achatina specularis* Morelet and *A. wildemani* Dautzenberg). Type by present designation: *Achatina specularis* Morelet, 1866.

Leptocalina is an amnectent group between the subgenera *Pintoa* and *Leptocallista*, agreeing in general shape with both of them. It has the smooth nepionic whorls of *Leptocallista*; but the remainder of the adult shell shows at least traces of sculpture and is rather dull or moderately shiny, not highly polished or glossy. It was originally defined as follows: "Shell with very fine, irregular growth-striae and more or less wrinkled or finely crenulate below the suture; no spiral engraved lines. Columella simple." The species here included are relatively small (40 mm. or less in length), with short aperture and the shape of *Limicolaria*. There are no microscopic engraved lines.

Bequaert and Clench at first included in *Leptocalina* only *A. specularis* and *A. wildemani*, the latter being now regarded as a mere color race of the former. I now propose to extend the group to several similar species from Angola and the Belgian Congo, as listed below. In all specimens I have seen of these species the nepionic whorls were smooth; but, as newly hatched snails were not available, the early whorls may have lost the sculpture. Some of the species may therefore have to be transferred later to *Pintoa*. Moreover it should be noted that the early whorls are sometimes irregularly pitted through corrosion of the periostracum; this should not be mistaken for a true granulation caused by decussation, such as is present in *Pintoa*.

1. *A. brooksi* Bequaert and Clench, 1934.
2. *A. colubrina* Morelet, 1866.
3. *A. dewittei* Bequaert and Clench, 1934.
4. *A. specularis* Morelet, 1866; with subsp. *wildemani* Dautzenberg, 1908.
5. *A. sylvatica* Putzeys, 1898 (Synonym: *Achatina putzeysi* Dautzenberg and Germain, 1914); with "mut." *unicolor* Pilsbry, 1919.
6. *A. thermalis* Bequaert and Clench, 1936.
7. *A. zebriolata* Morelet, 1866.

7. Subgenus LEPTOCALLISTA Pilsbry

Achatina subg. *Leptocala* sect. *Leptocallista* Pilsbry, 1904, Man. of Conch., (2), 17, pp. 73 and 75 (for *Achatina raffrayi* Jousseaume and *Stenogyra grandidieriana* Bourguignat).¹ Type by designation of Bequaert and Clench, 1934, Rev. Zool. Bot. Afric., 24, pt. 3, p. 273; *Stenogyra grandidieriana* Bourguignat, 1889.

Leptocallista agrees with *Leptocala* in having the post-nepionic as well as the nepionic whorls devoid of all trace of decussate sculpture, the entire shell being extremely smooth and glossy. It differs, however, in the absence of microscopic spiral engraved lines. In addition the base of the columella is somewhat flaring at the truncation. The few known species are restricted to East Africa.

1. *A. ariel* Preston, 1910.
2. *A. grandidieriana* (Bourguignat, 1889) (Synonym: *Achatina nitida* v. Martens, 1894).
3. *A. arthuri*, new name, for *Leptocala loveridgei* Bequaert and Clench, 1934; not *Achatina* (*Euaethiopina*) *loveridgei* (Clench and Archer, 1930).
4. *A. raffrayi* Jousseaume, 1883. The generic allocation of this species is somewhat open to question.

¹ Kobelt (1910) credits the name *Leptocallista* by error to Bourguignat.

8. Subgenus *LEPTOCALA* Ancey

Petitia Jousseume, 1884, Bull. Soc. Zool. France, **9**, p. 171 (for *Petitia petitia* Jousseume and *Achatina raffrayi* Jousseume). Type by present designation: *Petitia petitia* Jousseume, 1884 = *Achatina mollicella* subsp. *petitia*. Not of Chitty, 1857.

Leptocala Ancey, 1888, Bull. Soc. Mal. France, **5**, p. 70, footnote (new name for *Petitia* Jousseume, 1884; to include *Achatina mollicella* Morelet and *A. pulchella* v. Martens). Type by designation of Ancey, 1898, The Nautilus, **12**, p. 92: *Achatina mollicella* Morelet, 1860.

Achatina subg. *Leptocola* Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66. Misspelling of *Leptocala* Ancey, with same type. Not *Leptocola* Gerstaecker, 1883.

Jousseume's definition of *Leptocala* (under the name *Petitia*) is as follows (translated from the French): "This new genus may be characterized by saying that the shell is shaped like *Limicolaria*, but has the columellar truncation of *Urceus* (*Achatina* Lam.). The two species I have of the genus have a very thin shell and show over the surface longitudinal flammules darker than the ground color; the surface is glossy and shiny; the spire consists of 7 whorls; the embryonic nucleus is very voluminous." While the nepionic whorls are completely smooth and the post-nepionic whorls are also devoid of decussate or coarser sculpture, the surface is, however, densely covered with excessively fine, microscopic, slightly wavy, spiral engraved lines. The columella is simple at the basal truncation. The summit is bluntly conical and not in the least dome-shaped. The egg is no larger than usual in *Achatina* (5 by 4 mm. in *A. mollicella* subsp. *petitia*, according to d'Ailly). The only known species, restricted to Cameroon and Gaboon, is small (40 mm. or less in length), with relatively short aperture, thin, elongate oval.

1. *A. mollicella* Morelet, 1860; with subsp. *petitia* (Jousseume, 1884) (Synonyms: *Achatina pulchella* v. Martens, 1876, not of Spix and Wagner, 1827, nor of Pfeiffer, 1857; *Achatina smithii* G. B. Sowerby, 1890, not of Craven, 1881; *Achatina sowerbyi* E. A. Smith, 1890); and subsp. *zenkeri* (Bequaert and Clench, 1934). Pl. 58, fig. 5.

Genus *ARCHACHATINA* Albers

The Achatininae here gathered in *Archachatina* share only one feature differentiating them in every case from the species retained in *Achatina*. This is the wide, bulbous or dome-shaped summit of the shell, consisting of the nepionic (or embryonic) whorls produced by the snail before the egg hatches. This peculiarity is believed to be of

generic value, since it is correlated with the production by the snail of unusually large eggs, as compared with those of species of *Achatina* of approximately the same size. Possibly the anatomy may eventually disclose some additional feature of generic value; but, as this has been studied thus far for only four species, it would seem premature to draw general conclusions in this connection.

Archachatina has been used thus far almost universally for species restricted to West Africa, where they occur from Sierra Leone to the Belgian Congo. I propose to extend its limits here to include also several species of East and South Africa, where they are found from Abyssinia to the Cape Province. It should be noted, however, that as known at present the East and West African areas are not contiguous. The genus is not represented throughout a wide intervening area, which stretches from North to South across the Sudan, Uganda, the Belgian Congo, and the interior of South Central Africa.

All species included in the genus, on the basis of the dome-shaped apex and large egg, have the nepionic whorls decussately granulose. A further division of the genus must therefore be based on other characters of the shell. In an earlier paper Bequaert and Clench (1936, Rev. Zool. Bot. Afric., 29, pt. 1, pp. 73-96) arranged the West African forms in three subgenera.¹ I now propose to add a fourth subgenus for the East and South African species.

1. Subgenus ARCHACHATINA, proper

Achatina section *Archachatina* Albers, 1850, Die Heliceen, p. 189 (for several species). Type by designation of Pilsbry, 1904, Man. of Conch., (2), 17, p. 104: *Bulimus bicarinatus* Bruguière, 1792 = *Achatina sinistrorsa* Pfeiffer, 1848, one of the species originally included. As pointed out to me by Dr. H. A. Rehder (*in litt.*), Herrmannsen (1852) does not appear to have designated the type validly, as Bequaert and Clench (1936) believed.

Shell broadly oval, normally sinistral, large (110 to 150 mm. in length when full-grown, for $6\frac{1}{2}$ to 7 whorls), roughened by fairly strong axial striae and a few more prominent folds or welts, sometimes weakly and bluntly carinate at the periphery and below the suture. Outer lip unexpanded, thin, sharp. Columella strongly sinuous, very obliquely truncate. Nepionic shell bulbous, bluntly pointed, with fine and rather regular granulation, often worn in older shells. On the post-nepionic whorls the axial or vertical striae are cut at irregular intervals

¹ The authors had overlooked an earlier name introduced by Pilsbry (1919) for one of the new subgenera. Owing to the failure to see proof, their paper also contained some disturbing misspellings. These errors were corrected in 1935 (*The Nautilus*, 52, p. 26).

by fine spiral engraved lines, which become fainter or disappear on the body-whorl. The only known species, restricted to Prince's Island, San Thome, and the neighboring Islet of Rolas, all in the Gulf of Guinea, is *Archachatina* (*Archachatina*) *bicarinata* (Bruguière), of which *Achatina sinistrorsa* Pfeiffer, 1848, and *Achatina sinistrorsa* var. *carnea* Pfeiffer, 1867, are synonyms.

2. Subgenus CALACHATINA Pilsbry

Archachatina subg. *Calachatina* Pilsbry, 1919, The Nautilus, **32**, p. 99, footnote

3. Type by original designation: *Achatina marginata* Swainson, 1821.

Archachatina subg. *Megachatina* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 76. Type by original designation: *Achatina marginata* Swainson, 1821.

Archachatina subg. *Magachatina* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 78 (misspelling of *Megachatina*, with same type).

Pilsbry originally proposed *Calachatina* for "the dextral continental species, which have the surface smoothish and even", intending to include all species of *Archachatina* of the Manual of Conchology, with the exception of *A. bicarinata* (Bruguière). The subgenus is more restricted here, comprising only the species with the following characters. Full-grown shell medium-sized to large (80 to 180 mm. long), broadly oval or elongate oval, of $5\frac{1}{2}$ to 7 whorls, normally dextral, thick and often heavy. Surface fairly even; nepionic whorls of newly hatched shells finely granulose; later whorls either decussately sculptured or nearly smooth, sometimes with peculiar microsculpture. Outer lip of old shells more or less thickened, the edge flaring or expanded outwardly. Columella wide, more or less sinuous, strongly and obliquely truncate.

1. *A. degneri* Bequaert and Clench, 1936. See below.

2. *A. gaboonensis* Pilsbry, 1933. Although smaller and thinner than the other members of the subgenus, this species nevertheless forms when fully adult a thickened and slightly expanded outer lip. It seems related to *A. marginata*, although obviously transitional to subgenus *Megachatinopsis*.

3. *A. marginata* (Swainson, 1821). See below.

4. *A. rhodostoma* (Philippi, 1849). See below.

5. *A. ventricosa* (Gould, 1850). See below.

ARCHACHATINA (CALACHATINA) MARGINATA (Swainson)

Two main features distinguish the several variations of *A. marginata* from the related members of the genus. The first is the subsutural,

usually strongly marked engraved line, separated from the suture by a narrow depressed area covered with irregular, low, vertical folds, the suture itself being straight or very slightly wavy, not crenulate. The engraved line starts on the fourth or fifth whorl and is often deep and prominent, particularly on the body-whorl; but occasionally it is weak or almost lacking, especially in subsp. *eduardi* Pilsbry. The second feature is a peculiar microsculpture of the body-whorl, only visible with the proper magnification. It consists of numerous extremely fine, close-set, criss-cross or anastomosing lines, making the surface of the periostracum look as if it had been pressed with a very finely woven cloth. This "weave" type of microsculpture is more pronounced in some forms or races than in others. It is particularly conspicuous when the periostracum is well developed and preserved, as is more common in some of the Cameroon races, such as subsp. *egregia*. In old shells, even when taken alive, the microsculpture is sometimes almost completely worn off, but traces of it may generally be detected in a few spots. The nepionic whorls, when well preserved, as in newly hatched or very young shells, are densely covered with regular spiral and vertical rows of minute granulations, which become coarser on the first post-nepionic whorls (Pl. 76, fig. 4). The granulation, due to the decussation of close-set vertical growth-striae by evenly spaced spiral engraved lines, gradually disappears on the penultimate whorl and is almost wanting on the body-whorl, except sometimes below the suture. The growth-striae are, moreover, very weak on the body-whorl, which appears nearly smooth to the naked eye.

Synopsis of Subspecies. While most other species of *Archachatina* have a limited distribution, *A. marginata* covers a very wide territory, extending at least from Dahomey to the Lower and Middle Belgian Congo, and possibly in French Equatorial Africa to the Gribingui River (about 7° N., 19° W.). As a result it has produced several intraspecific variations, sometimes well segregated geographically, but more often overlapping, yet well worthy of varietal or subspecific names. These races are defined primarily by color peculiarities, in some cases also by the average size or the general shape. All of them have retained the characteristic microsculpture. As they frequently occur in the same territory with specimens of the typical race, although perhaps in a different type of environment, it is not surprising that connecting examples occur in some localities.

A. Shell fairly uniformly marked with numerous chestnut-brown or pale brown vertical streaks, stripes, zigzag lines, or blotches on a straw-yellow background.

a. Large and broad, up to 176 mm. long. Columella, outer lip and parietal wall white or bluish-white. Apex pale colored or roseate. Typical *marginata*.

b. Large and broad, shaped like the typical form, up to 170 mm. long. Outer lip white or bluish-white. Columella and parietal wall more or less extensively apricot-yellow. Apex yellowish. Subsp. *ovum*.

c. Medium-sized to fairly large, but usually more slender and with narrower body-whorl than the typical form, up to 135 mm. long. Outer lip white or bluish-white. Columella and parietal wall more or less extensively vinaceous-red. Apex usually, but not always reddish. Subsp. *suturalis*.

d. Small and unusually slender for the species, up to 110 mm. long, with relatively long and narrow aperture. Columella, parietal wall and outer lip white or bluish-white. Apex usually pale colored. Subsp. *eduardi*.

B. Lower half of body-whorl, or of earlier whorls in immature shells, mostly very dark chestnut-brown, except for a narrow, well-defined straw-yellow zone at the base around the columella; remainder of shell (above the periphery) marked as in the typical form. Medium-sized and moderately broad, up to 110 mm. long.

e. Columella, parietal wall and broad inner margin of outer lip vinaceous-red. Apex vinaceous-red. Subsp. *egregiella*.

f. Columella and parietal wall vinaceous-red. Inner margin of outer lip bluish-white or darkened. Apex yellowish or slightly roseate. Subsp. *egregia*.

g. Columella, parietal wall and inner margin of outer lip bluish-white. Apex pale colored or slightly roseate. Subsp. *clenchi*.

C. Shell mostly or uniformly straw-yellow or olive-yellow, without or with mere traces of darker markings.

h. Large and broad, shaped like the typical form, up to 136 mm. long. Columella, parietal wall and outer lip white or bluish-white. Apex pale colored. Subsp. *icterica*.

i. Large and broad, shaped like the typical form, up to 105 mm. long. Outer lip white or bluish-white. Apex, columella and parietal wall partly or mostly rose or vinaceous-red. Subsp. *grevillei*.

j. Small and relatively narrow, about 80 mm. long. Columella, parietal wall and outer lip white or bluish-white. Apex pale colored. Subsp. *candefacta*.

a. Typical *A. MARGINATA*

Pl. 9, fig. 3; Pl. 59, fig. 1; Pl. 64, fig. 1; Pl. 67, fig. 2; Pl. 68, fig. 1; Pl. 71, fig. 3; Pl. 75, fig. 2; Pl. 76, figs. 3-4; Pl. 80, fig. 4

[*Buccinum parvum integrum*, etc., Gualtieri, 1742, Index Test. Conch., Pl. 45, lower fig. B only; with letterpress].¹

¹ Bequaert and Clench (1936, p. 79) included in the synonymy of *A. marginata* also Gualtieri's upper fig. B, as well as Pl. 71, figs. 1-3 and 7-9 of Seba (1758). A more careful study of these figures has now led me to refer them to *Achatina achatina* (Linné).

- [The Heirs of G. W. Knorr, 1768, Vergnügen der Augen und des Gemüths, **3**, second printing of the Plates of the 1st Edition, Pl. 3**, fig. 1 (Plate marked "ex Museo Schadeloockiano"; not the accompanying text which describes *Archachatina knorrii*, shown on the first printing of the same Plate 3**); 1768, Délices des Yeux et de l'Esprit, **3**, second printing of Pl. 3**, fig. 1 (as above); 1772, Verlosting der Oogen en van den Geest, (Amsterdam), **3**, p. 86 (new text, not a translation from the original German or French); Pl. 3**, fig. 1 (same Plate as above)].¹
- [? J. S. Schröter, 1782, Mus. Gottwaldiani Test., Pl. 35, fig. 220 (very poor figure)].

Achatina marginata Swainson, 1821, Zoolog. Illustr., Conchology, **1**, Pl. 30 ("Coast of Guinea"). Gray, 1825, Ann. of Philosophy, (N.S.), **9**, p. 414. Jay, 1839, Cat. Shells Coll., 3d Ed., p. 58. Swainson, 1840, Treatise on Malacology, p. 170, fig. 23. Pfeiffer, 1841, Symbolae Hist. Helic., **1**, p. 28. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 165. Gray, 1847, Proc. Zool. Soc. London, (for 1847), p. 177. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 249 (in part). Mörch, 1852, Cat. Conch. Yoldi, **1**, p. 20. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 482. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Shuttleworth, 1856, Notitiae Malacologicae, **1**, p. 33 (young shell). Morelet, 1858, Séries Conchyl., **1**, p. 19 (Gaboon). Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 600; 1860, Syst. Conch.-Cab., **1**, Abt. 13, pt. 1, p. 328; Pl. 29, fig. 1 (specimen). A. D. Brown, 1861, Cat. Shells Coll., p. 55. Mörch, 1863, Cat. Conchyl. Lassen, p. 4. Marrat, 1865, Cat. Coll. Dennison, p. 30. Bielz, 1865, Verzeichn. Moll. Conch.-Samml., 3d Ed., p. 23. Morelet, 1867, Voy. Welwitsch, Moll. Terr. Fluv., (1868), p. 65 (Southern Nigeria: Banks of the Niger). v. Martens, 1868, Malak. Blätt., **15**, p. 137. Haines, 1868, Cat. Terr. Shells Coll., p. 68. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 212. Paetel, 1869, Moll. Syst. Cat., p. 80; 1873, Cat. Conch.-Samml., p. 99. Dohrn, 1873, Malak. Blätt., **21**, p. 80. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 53. Pfeiffer, 1877, Monogr. Helic. Viv., **8**, p. 272. G. R. Batalha, 1878, Cat. Coll. Conchyl. F. R. Batalha, p. 2. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 145. v. Martens, 1882, Jahrb. D. Mal. Ges., **9**, p. 245 (French Congo: mouth of the Quillu [=Kwilu] River on the Loango Coast). Grasset, 1884, Index Test. Viv. Coll., p. 199. Reyes y Prosper, 1886, An. Soc. Españ. Hist. Nat., **15**, p. 340 (Spanish Guinea: Ellobey Id.). Martorell y Peña, 1888, Catálogo Colección Conchol. Museo Martorell, Barcelona, p. 56. v. Martens, 1888, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 148 (Cameroon: Barombi. Egg). Vignon, 1888, Bull. Soc. Mal. France, **5**, p. 68 (Gaboon). Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240. v. Martens, 1891, Sitzungsber. Ges. Naturf. Fr. Berlin, pp. 30 and 33. d'Ailly, 1896, Bih. Svenska Vet.-Ak. Handl., **22**, Afd. 4, No. 2, pp. 61 and 69, fig. (Cameroon: Massaka in Batanga District; Mekango; Etome; Ndiang; part of these

¹ See my remarks on Knorr's work in the discussion following the bibliography.

- specimens only.¹ Radula; oviposition). Boucard, 1901, Cat. Coll. Coquilles Terr., p. 49. O. Boettger, 1905, Nachrichsbl. D. Mal. Ges., **37**, p. 165 (Cameroon: Rombone; Kurume on Bali Road; Kan on Bali Road; Mukonje Farm; Kokobuma. Egg; epiphragm). Germain, 1905, Bull. Mus. Hist. Nat. Paris, **11**, p. 250 (French Equatorial Africa: banks of the Gribingui River); 1907, Arch. Zool. Gén. Expér., (4), **6**, pt. 4, p. 128. E. Smith, 1908, Proc. Mal. Soc. London, **8**, pt. 1, p. 2 (living specimen from Southern Nigeria: Ibadan, 100 miles inland). Germain, 1908, in A. Chevalier, L'Afrique Centrale Française, p. 487. Hidalgo, 1910, Mem. Soc. Españ. Hist. Nat., **1**, No. 29, p. 508 (Spanish Guinea). Talbot, 1912, In the Shadow of the Bush, p. 473 (Southern Nigeria: Oban District). Tessmann, 1913, Die Pangwe, **2**, pp. 135 and 190 (Spanish Guinea). Spence, 1925, Jl. of Conch., **17**, pt. 8, p. 248 (Cameroon: Mohive near Victoria; Isongo; Misse Uele near Tiko); 1928, *Op. cit.*, **18**, pt. 7, p. 213 (Cameroon: Ferme Suisse, 10° 7' E.; 3° 35' N.). W. P. Lowe, 1932, The Trail That is Always New, (London), p. 132 (Southern Nigeria: Lagos; feeding on dead rat); 1943, The Ibis, **85**, p. 101 (feeding on dead bird).
- Cochlitoma marginata* G. B. Sowerby, 1825, Cat. Shells Earl Tankerville, p. 38. Standen, 1917, Jl. of Conch., **15**, pt. 6, p. 161 (egg; oviposition).
- Helix* (*Cochlitoma*) *marginata* Rang, 1831, Ann. Sci. Nat., **24**, p. 33 (in part: the description, but possibly only Axim, in the Gold Coast, of the localities mentioned).
- Achatina* (*Achatina*) *marginata* Beek, 1837, Index Moll., pt. 1, p. 75. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 201 (in part: not the shell with reddish apex). Semper, 1874, Reisen Arch. Philippinen, pt. 2, Wiss. Res., **3**, fasc. 2, p. 144 (animal; anatomy; radula; jaw).
- Oncaca marginata* Gistel (or Gistl), 1848, Naturgesch. d. Thierreichs, p. 168; Pl. 5, fig. 29.
- Achatina* (*Archachatina*) *marginata* Albers, 1850, Die Heliceen, p. 190. Germain, 1911, Bull. Mus. Hist. Nat. Paris, **17**, p. 224; 1912, Ann. Inst. Océanogr. Monaco, **5**, pt. 3, p. 123 (Dahomey: Abomey; Porto Novo); figs. 3A–B, on p. 124 (young shells); 1916, Ann. Mus. Civ. Genova, **47**, p. 244 (Fernando Po: Bahía de San Carlos. Gaboon: Fernand Vaz); 1917, Bull. Mus. Hist. Nat. Paris, **23**, p. 511 (Dahomey: Igbin). Dautzenberg, 1921, Rev. Zool. Afric., **9**, pp. 92 and 96 (Ivory Coast: Assinie; this locality may have been due to erroneous labelling). Bofill and de Aguilar-Amat, 1924, Trab. Mus. Cienc. Nat. Barcelona, **10**, pt. 2, p. 6 (Spanish Guinea: Itime, Río Mayani). Germain, 1926, C. R. Congr. Soc. Savantes, (1925), Sciences, p. 493.
- Achatina* (*Achatinus*) *marginata* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 167; 1879, Nomencl. Helic. Viv., p. 264. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 123.
- Archachatina marginata* Pilsbry, 1904, Man. of Conch., (2), **17**, p. 109 (Gaboon. Dahomey); Pl. 24, figs. 22 (young shell) and 23 (adult specimen); Pl. 25,

¹ d'Ailly examined from Cameroon 12 shells of the nominate race of *A. marginata* and over 70 of subsp. *suturalis* (his var. *gracilior*); but he did not state how they were divided among the localities listed.

- fig. 26 (adult shell); 1905, *Op. cit.*, (2), 17, pp. ix, fig. 1 (radula, after d'Ailly), and xiv (animal, anatomy, jaw, radula). Nobre, 1909, Bull. Soc. Portugaise Sc. Nat., 3, Suppl. 2, p. 91. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 66. C. R. Boettger, 1927, *Op. cit.*, 39, pt. 4, p. 355 (Belgian Congo: Duma). Lamy, 1929, Jl. de Conchyl., 73, p. 202 (egg). C. R. Boettger, 1932, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 303 (in part. Gaboon: shells from mouth of Monda River, north of Libreville, only);¹ 1934, *Op. cit.*, (for 1933), p. 447 (Gaboon: mouth of Monda River). Haas, 1935, Arch. f. Molluskenk., 67, pt. 3, p. 108 (introduced with bananas at Frankfurt a. Main, Germany; erroneously stated to have come from Jamaica, but actually from Cameroon). Darteville, 1936, Rev. Zool. Bot. Afric., 29, p. 8 (Coast of Gaboon. Also one dead shell from Belgian Congo: Kifuenda near Banana); 1936, *Op. cit.*, 29, Bull. Cercle Zoologique Congolais, 13, pt. 1, p. (4) (Belgian Congo: Nouvelle Anvers). Bequaert and Clench, 1937, The Nautilus, 51, p. 34. C. R. Boettger, 1938, Sitzungsber. Ges. Naturf. Fr. Berlin, (for 1937), p. 314 (live specimens, introduced from Cameroon, found on a city dump near Berlin, Germany); 1938, *Op. cit.*, (for 1938), p. 83. Coen, 1945, Catalogo Gasteropodi Polmonati Coll. Coen, p. 43. C. R. Boettger, 1947, Arch. f. Molluskenk., 76, pts. 1-3, pp. 66 and 67.
- Archachatina (Megachatina) marginata* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., 29, pt. 1, pp. 76 and 79 (Cameroon: Yaunde; Sakbayeme; Sangmelima. Fernando Po. Gaboon. Southern Nigeria: Old Calabar. Dahomey).
- Archachatina (Calachatina) marginata* C. R. Boettger, 1940, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 233 (Cameroon: Ndongo near Likomba).
- Helix (Cochlitoma) amphora* Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, pp. 54 (or 50) (*nomen nudum*) and 74 (or 70) (with *A. marginata* Swainson as a variety).
- Achatina amphora* Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 163.
- Archachatina marginata* var. *amphora* Pilsbry, 1904, Man. of Conch., (2), 17, p. 110; Pl. 25, fig. 26 (specimen) (says this name might be used for the largest shells of the species, if these were separated as a variety).
- Achatina schweinfurthi* var. *foureaui* Germain, 1905, Bull. Mus. Hist. Nat. Paris, 11, p. 251 (French Sudan: Sabakaufi in Damergu Country), fig. 1 (type); 1907, Arch. Zool. Gén. Expér., (4), 6, pt. 4, p. 128; 1908, in A. Chevalier, L'Afrique Centrale Française, p. 488, fig. 87.
- Achatina (Archachatina) marginata* var. *foureaui* Germain, 1908, Nouv. Arch. Miss. Sci. Litt., (3), 16, p. 158 (with very brief description. Gaboon: banks of the Mawisch or Marwisch River); 1911, Bull. Mus. Hist. Nat. Paris, 17, p. 224, fig. 50 (type). Dautzenberg, 1921, Rev. Zool. Afric., 9, p. 95.
- Archachatina (Megachatina) marginata* var. *foureaui* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., 29, pt. 1, p. 84.
- Achatina (Archachatina) marginata* var. *foureauxi* "Germain" Dautzenberg, 1921, Rev. Zool. Afric., 9, p. 95 (as a synonym of var. *foureaui*. I cannot find that Germain ever used the spelling *foureauxi* in print).

¹ The specimens from Lambarene were *Archachatina gaboonensis* var. *lambarenensis* Pilsbry.

- Archachatina (Megachatinops) gaboonensis* var. *aquatorialis* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 90 (Belgian Congo: Kunungu near Bolobo, holotype; Stanleyville, paratype); Pl. 1, fig. 4 (paratype); Pl. 2, fig. 14 (holotype).
- Archachatina aquatorialis* Darteville, 1939, Rev. Zool. Bot. Afric., **33**, Bull. Cercle Zool. Congolais, **16**, pt. 1, p. (23) (Belgian Congo: Yahuma, 1° 15' N., 23° E.).
- ? *Achatina paivana* Vignon, 1888, Bull. Soc. Mal. France, **5**, p. 71 (Ivory Coast: Grand Bassam. According to Ancy, *Op. cit.*, p. 71, footnote, Vignon's shell was *A. marginata*, in which case the locality was most probably erroneous). Not of Morelet, 1866.
- Achatina intuslaesceus* "Paiva" Nobre, 1909, Bull. Soc. Portugaise Sc. Nat., **3**, Suppl. 2, p. 91 ("Guinea"; as a synonym of *A. marginata*).

Original description of *A. marginata* Swainson (1821): "A. testa ovato-oblonga, strigis inaequalibus ferrugineis; spira ad apicem obtusa, 5-voluta; sutura depressa linea sulcata marginali. Shell ovate-oblong, with irregular ferruginous stripes; spire obtuse at the tip, of 5 volutions; the suture depressed, with a marginal indented line." Additional remarks: "Spire of 5 whorls, the last or terminal one [at apex] very small and flattened; the apex obtuse; the suture depressed, as if flattened on the shell, and margined by 1 or sometimes 2 indented lines, parallel, and at the top of each whorl. In the colour of its mouth varying in sometimes having a tinge of rose-colour at the base and top of the spire, but the mouth is more generally white. The body-whorl is more or less ventricose; the outer lip is a little reflected, and the whole shell when full grown, much thicker and heavier than any of the other species. The epidermis is yellowish-brown, beneath which the shell is nearly white, beautifully marked with broad remote stripes of chestnut, with others more slender (and sometimes broken into spots) between." Of the three references given, only the one to Gualtieri (1742) refers correctly to typical *A. marginata*. Swainson's description was clearly based on two color forms; but his excellent figure shows the form without pink at the apex and with columella and parietal wall white, which I herewith designate as the nominate race of the species. This figure, copied in my Pl. 9, fig. 3, shows on a slant a shell not fully grown, with the outer lip scarcely expanded, smaller than average for the species. It is 104 mm. in length, 55 mm. in greatest width, with the aperture 59 by 29 mm. The surface shows no trace of decussate, spiral or granulose sculpture. The figured type appears to be lost.

A. marginata var. *fourneaui* was at first (1908) introduced with a few descriptive words: "a very fine variety with thin shell." A full description was published in 1911 (translated from the French): "Shell globular-ventricose, widened basally; spire only a little raised,

of $5\frac{1}{2}$ convex, rapidly increasing whorls separated by almost horizontal and distinctly marginate sutures; last whorl [=body-whorl] very large, ventricose-globular, widened basally; columella curved, scarcely twisted, strongly truncate; aperture pyriform, very acute at upper end, broadly convex below and outwardly. Length 95 mm.; greatest diameter, 62 mm.; lesser diameter, 50 mm.; height of aperture, 61 mm.; diameter of aperture, 33 mm. Shell thin, light, translucent; first whorls reddish, the remaining having on a greenish-yellow background longitudinal [=axial or vertical] narrow, flame-like streaks of dark chestnut-brown narrowly bordered with reddish; these flame-like, not zigzag-shaped streaks extend to the mouth. The first whorls of the spire are almost smooth (longitudinal striae very fine, scarcely oblique); the others show longitudinal, slightly oblique, somewhat wavy striae, very distinctly wrinkled near the sutures and cut, near the sutures, by spiral striae producing a decussate appearance. Aperture inside pale Russian blue, somewhat shiny; parietal callus of the same color; columella whitish." The figure shows a decidedly immature shell, which accounts for the few whorls. The locality was first spelled "Mawisch River" (1908); later "Marvisch River" (1911). I have been unable to locate it on any map. The type of *fourneaui* could not be found at the Paris Museum in 1933. The original drawing of the type is copied in my Pl. 76, fig. 3. Spence's (1928) *A. marginata* var. *fourneaui*, from Southern Nigeria, said to be "a small, thin form," appears to have been *A. marginata eduardi* Pilsbry.

Germain (1905) described his *A. schweinfurthi* var. *foureaui* as follows (translated from the French): "Transitional between *Achatina schweinfurthi* and *A. marginata*. Compared with typical *schweinfurthi*, the var. *foureaui* differs in the spire, the first whorls of which are proportionately less raised; in the aperture being wider at the base and more broadly convex toward the outer margin; in the more twisted columella (the columella duplicates almost exactly that of *A. marginata*); finally in the smaller size. This variety cannot be referred to *Achatina zanzibarica* Bourguignat, although it has about the same dimensions. It differs from this in the much more twisted columella (in *A. zanzibarica* the columella is even less twisted than in *A. schweinfurthi*), but especially in the aperture being much more widened at the base, as shown in the figure. Length 177 mm. [evidently an error for 107 mm., as the figure, said to be two-thirds natural size, indicates]; greatest width, 58 mm.; length of aperture, 63 mm.; width of aperture, 36 mm." *A. schweinfurthi* v. Martens is a true *Achatina*, and the var. *foureaui* is clearly in no way related to it. From the photograph in my Pl. 80, fig. 4, as well as from the original figure, copied in my Pl. 75, fig. 2, *foureaui* is a fully adult specimen of the nominate form of *A.*

marginata, with expanded outer lip. The record cannot, however, be used as evidence that the species now occurs alive in the Damergu country, which is in the semi-desertic section of the French Sudan (about 15° N., 9° W.). Most probably the specimen had been carried in dead condition to the locality by natives. A study of the type at the Paris Museum in 1933 had already led me to the conclusion that *fourcaui* was typical *marginata*.

Copy of the original description of *A. gaboonensis* var. *aequatorialis*: "In general outline, shape of spire and type of sculpture, similar to typical *gaboonensis* and its var. *lambarenensis*, but differing in the type of color markings. The first two and a half whorls isabelline; the next half whorl reddish-brown passing rather abruptly into axial streaks of dark chestnut-brown overlying a ground color of dull orange-yellow; starting on the third whorl and continuing to the aperture, there are numerous chestnut-brown flecks disposed irregularly over the entire surface, but most prominent in the yellow intervals between the chestnut streaks; the individual flecks are approximately 1.5 by 1 mm. in size; the aperture and columella are pale whitish-blue." The holotype is 92.5 mm. long, 55 mm. wide, of 6 whorls, the aperture 57.5 by 30 mm.; the corresponding measurements of the paratype are 120.5 mm., 68.5 mm., aperture 70.5 by 37 mm., of 6¼ whorls. A more careful study of the holotype and paratype shows that they are immature *A. marginata* of the nominate form; they have the characteristic microsculpture of that species, which is entirely lacking in *A. gaboonensis*. Both types are shown in my Pl. 64, fig. 1, and Pl. 67, fig. 2.

Of the early figures which I refer to *A. marginata*, Gualtieri's (1742) lower fig. B of Pl. 45, copied somewhat reduced in my Pl. 68, fig. 1, seems to show the nominate race. The accompanying text reads: "Buccinum parvum, integrum, ore obliquo, ventricosum, striatum striis per longitudinem aequaliter percurrentibus, albidum, fulvidis, et vinosis maculis undatim depictum, et variegatum." Unfortunately it does not mention the color of the columella nor of the aperture inside, and moreover covers also the upper fig. B, which represents *Achatina achatina* (Linné). In the original, lower fig. B is 182 mm. long, 108 mm. wide, with the aperture 117 by 55 mm. The number of whorls cannot be determined, as the earlier ones were overlooked by the draughtsman. It exceeds the largest specimen now known of the species and I strongly suspect that it was drawn over-size.

Knorr's well-known pictorial work has a complicated history, which it would be a task in itself to try to unravel. The following few remarks are, however, essential to clear up the misunderstanding that may arise concerning Pl. 3**, fig. 1. The first edition of the book, in

six parts, each with its own pagination of the text and each with 30 Plates colored by hand, appeared from 1757 to 1773. It was issued with a German or with a French text in separate copies. The German text was written by P. E. S. Müller of Erlangen. I have not been able to find who made the French translation, which is fairly literal. Only the first part was published by G. W. Knorr himself, the other parts being issued after his death by his Heirs. In all German or French copies known of this first edition the text and pagination are identical and there appears to have been only one printing of the text. In parts 1, 2, 4, 5, and 6 the Plates are also identical in all copies of both languages, so far as I know. Of part 3 there were, however, two different printings of the Plates, for both the French and German texts. Some of the Plates show different species in the two printings; in others the species are the same, but redrawn or engraved anew, as they are often in a slightly different position. As I have not seen the matter referred to in print, I am unable to offer an explanation.¹ Of the first edition there exists also a Dutch translation, or rather adaptation, the Dutch text resembling only vaguely or not at all the original German or French issues, and also carrying a different pagination. The pagination runs continuously through parts 1 to 3 (pp. 1-118) and again through parts 4 to 6 (pp. 1-118), the last part concluding with a Register of 24 unnumbered pages. Each part has the original number of 30 Plates, identical with the German and French issues, but those of part 3 are of the second printing.²

According to Boehmer (1786, *Bibliotheca Scriptorum Historiae Naturalis, Zoolog.*, 2, p. 444), an entirely new German edition of Knorr's work was started later with a corrected text, the first part appearing in 1776 (revised text by P. E. S. Müller), the second in 1784 (revised text by Meuschen). The pagination was continuous through these two parts (pp. 1-240). I have not seen this second edition. I do not know whether it was ever completed nor whether part 3 was issued. No corresponding French text appears to have been published.

Coming now to Pl. 3**, fig. 1 of part 3, in the first printing this unquestionably represents *Archachatina knorrii* (Jonas), from the back, as may be seen from my copy in Pl. 39, fig. 2. It also agrees with the accompanying text, which I reproduce in my discussion of *A. knorrii*.

¹ So far as known, in every German or French copy of part 3, the Plates are either all of the first or all of the second printing. I regard as of the first printing the Plates showing shells which agree with the corresponding descriptions in the text. These descriptions often disagree with the shells shown in the second printing.

² The library of the M.C.Z. has two French copies of the first edition, each with a different printing of the Plates for part 3. The U.S.N.M. library has a German and a French copy, both with the second printing of the Plates for part 3. The Ac.N.S.Phila. has a German copy with the first printing for the Plates of part 3. The Department of Mollusks of the M.C.Z. was recently given a Dutch copy by Mr. Richard Foster.

In the second printing, however, Pl. 3**, fig. 1, copied in my Pl. 71, fig. 3, is not *A. knorrii* at all, but a small example of *A. marginata*, 117 mm. long, 68 mm. wide. As it is shown from the back, the color of the columella is unknown; but as the summit is painted yellow, the shell presumably was of the nominate race.

A. marginata appears to be mainly a terrestrial snail. In Cameroon, R. Rohde (quoted by O. Boettger, 1905) found it estivating underground during the drier months, having closed the aperture with a solid, calcareous, white epiphragm. According to P. A. Talbot (1912), when the crawling snail is disturbed it produces a peculiar "screaming" noise by rapidly retracting into the shell. This species does not cause any appreciable damage to native crops; on the contrary, it is considered as an economic asset among many native West African tribes who include it in their diet. The solid, capacious and rather handsome shells lend themselves to many household purposes so that very large, usually badly worn specimens may be rather easily obtained in native villages.

Although d'Ailly (1896) claimed, but not from personal observation, that the snail oviposits on trees, in the forks of the branches close to the main trunk, he did not describe the egg. Correlated with the sizeable embryonic (or nepionic) shell, the egg is large. It was described by v. Martens (1888), O. Boettger (1905), Standen (1917) and Lamy (1929). O. Boettger says that it measures 20 to 20.5 mm. in length and 14 to 14.5 mm. in width in the nominate race of the species. The eggs which Standen described, from Fernando Po, were oblong oval, yellowish-white, 19 by 14.5 mm.; according to the collector they had been deposited on the ground at the foot of trees.

The newly hatched shell is 15 to 15.5 mm. long, 12 to 12.5 mm. in greatest width and consists of about $3\frac{1}{2}$ whorls. A little less than the first whorl is smooth; then appear fine, vertical, slightly curved, oblique wrinkles, cut by many closely-set, fine, transverse engraved lines, producing regular spiral rows of granules, which increase gradually in size. The terminal embryonic shell is obtusely carinate at the periphery, below which it is at first smooth and shiny, later dull and covered with the "weave" criss-cross microsculpture I have described for the adult shell. The base of the columella is obliquely truncate and provided with a distinct, deep umbilical slit only partly covered by the reflexed outer edge, as was first pointed out by Shuttleworth (1856). The umbilicus closes rapidly in the post-nepionic stage, as I can find no trace of it in a shell only 23 mm. long.

Specimens Examined. Several in various museums (M.C.Z.; U.S.-N.M.; Amst.M.; A.M.N.H.; Ac.N.S.Phila.; etc.) merely labelled "Africa" or "West Africa." — DAHOMEY: without precise locality

(M.C.Z.; Ac.N.S.Phila.). — NORTHERN NIGERIA: Egbe, south of Niger R. (Miss Clark.—U.S.N.M.). — SOUTHERN NIGERIA: Ado near Lagos (A.S. Pearse.—U.S.N.M.); Calabar (Brus.M.); Old Calabar (U.S.N.M.). — FERNANDO PO: (M.C.Z.). — CAMEROON: Sakbayeme near Edea (G. Schwab.—M.C.Z.); Yaunde (Ac.N.S.Phila.; M.C.Z.); Lolodorf (E. D. Horner.—M.C.Z.); Ngon near Ebolowa (Miss E. M. Daniels.—M.C.Z.); Kribi (Leid.M.); Bitye (Terv.M.); Metet (K.D. Grissett.—M.C.Z.); Sangmelima (M.C.Z.). — SPANISH GUINEA: Corisco Id. (A.M.N.H.; M.C.Z.); mouth of Benito River (M.C.Z.). — FRENCH CONGO: Gaboon (Terv.M.; Ac.N.S.Phila.; U.S.N.M.; M.C.Z.). — BELGIAN CONGO: Luvituku (Terv.M.); Lower Congo (Weyns.—Terv.M.); Kisala, Mayumbe (H. Schouteden.—M.C.Z.; Terv.M.); Duma on the Ubangi River (A. Schubotz.—Frankf.M.); Stanleyville, paratype of *A. gaboonensis* var. *aequatorialis* (J. Ghesquière.—M.C.Z. No. 103894); Kunungu near Bolobo, holotype of *aequatorialis* (Terv.—M.).—A very large, dead and much weathered specimen was picked up by Dr. W. Mann somewhere in Liberia; most probably it had been imported from Fernando Po or Cameroon by some native. No living specimens of *A. marginata* have been ever seen in Liberia.

There is at present no trustworthy evidence that true *A. marginata*, or any of its several races, have ever been found alive west of Dahomey. The older records by Rang (1831) for Liberia and the Ivory Coast, repeated by Pfeiffer (1848), were doubtless based on *A. ventricosa*, which was only recognized several years later as a distinct species. Rang's description, however, fits true *marginata* well and may have been based mainly on the specimen he cites from Axim on the Gold Coast. It is uncertain, nevertheless, whether *A. marginata* actually lives at present on the Gold Coast; even though v. Martens later (1866) described his var. *gracilior* (= *eduardi* Pilsbry) also from Axim. Vignon's (1888) supposed *A. paivana*, from Grand Bassam, which Ancy stated was *A. marginata*, if actually found alive there, may have been *A. ventricosa*; more probably it was from the Gaboon, where Vignon did most of his collecting. Dautzenberg's (1921) record from Assinie, although included in my bibliography of *marginata*, is open to question. No doubt dead specimens of *marginata* are often carried about by natives far from their true habitat, as large examples of this species lend themselves well to various domestic uses. This may account for their being found in native villages outside the true range of the species. The unusually large specimen found by Dr. W. Mann in Liberia was probably brought there from Fernando Po by a returning laborer. The possibility must also be considered that this snail may be transported to new territory as young or eggs. Live immature examples were introduced from Cameroon into Germany on at least

two occasions. Moreover, C. R. Boettger (1938) reported that in August, 1937, two live young *A. marginata*, respectively 24.5 and 24.2 mm. long, were found in the open on a city dump at Berlin-Blankenfelde. These importations were due to transport with bananas.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Width		
176 mm.	100	104	54	7½		"Liberia" (?)
150	81.5	87	44	7½		Sakbayeme
145	97	98	53	7½		"West Africa"
141	84	86	47	7½		Gaboon
141	88	87.5	47	7½		Corisco
140.5	77.5	79.5	42	7½		Egbe
137.5	83	83	44	7½		Sangmelima
137	88	85	49	7½		"West Africa"
136	87	87.5	46	7½		Gaboon
135.5	80	85	42	7½		Corisco
133	79	83	46	7¼		"West Africa"
130	81	77	47	7		Gaboon
127.5	73	73	39	7		"West Africa"
120	70.5	71	36	7		Sakbayeme
115	77	72	41	7		Corisco
114.5	70	71.5	38	7		"West Africa"
109	62	66	35	7		Old Calabar
102.5	63	63.5	35	6½		"West Africa"
102.5	58	58	30	6½		Gaboon
90	55	54	30.5	6		"
85.5	50	50	26	6		"West Africa"

The nominate race of *A. marginata* averages nearly 130 mm. in length and 80 mm. in greatest width.

b. *A. MARGINATA OVUM* (Pfeiffer)

Pl. 11, fig. 3; Pl. 70, fig. 1

Achatina ovum Pfeiffer, 1858, Malak. Blätt., **5**, p. 238 (no locality); 1860, Novit. Conch., **2**, p. 154; Pl. 40, figs. 3-4 (2 views of type; name misspelled "*orum*" on Plate); 1868, Monogr. Helic. Viv., **6**, p. 215; 1876, *Op. cit.*, **8**, p. 274. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240.

Achatina (Achatinus) ovum Pfeiffer, 1879, Nomencl. Helic. Viv., p. 265.

Archachatina ovum Pilsbry, 1904, Man. of Conch., (2), **17**, p. 111; Pl. 24, figs. 20-21 (after Pfeiffer). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66.

Archachatina (Megachatinops) ovum Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 92.

Original description of *A. ovum*: "T. ovata, tenuis, laevigata, fulvo-lutea, strigis angustis rufis, saepe maculosis interruptis picta; spira conica, sursum carnea, obtusa; sutura late marginata; anfr. 6 convexiusculi, superi sub lente minute granulati, ultimus spiram paulo superans, ventrosus; columella aurantiaco-carnea, arcuato-torta, basi vix truncata; apertura ampla, parum obliqua, late angulato-ovalis, intus concolor, submargaritacea; perist. simplex, tenue. Long. 65, diam. 35 mill. Ap. 38 mill. longa, medio 22 lata." This description is repeated in 1860, the additional German and French text being merely literal translations of the Latin diagnosis. The type, from the Cuming Collection, is now at the British Museum, where I saw it in 1933. It was then recognized as an immature specimen of a form of *A. marginata*, but the color of the columella, described as "orange flesh-colored" by Pfeiffer, was not noted at the time. This is, moreover, not shown in Pfeiffer's fig. 3, copied in my Pl. 11, fig. 3. At my request, Mr. T. Pain has recently examined the type once more. He reports that it "appears to have faint traces of very pale orange on the columella." In the material I have seen the orange color characteristic of this subspecies is always much less marked in immature than in full-grown shells.

Subsp. *ovum* is in fully adult specimens similar to the nominate race in size, general outline and shape of aperture, as well as in sculpture, having also the characteristic "weave" microsculpture. The coloration is the same, except for the columella which is more or less apricot-yellow, this color often extending upward over much of the glazed area of the parietal wall; a narrow outer zone of both parietal wall and columella remains bluish-white. The summit of the spire (first three whorls) also is usually suffused with yellow or orange-yellow.

Specimens Examined. SOUTHERN NIGERIA: Lagos, many specimens (A. Mead; Philip Souza.-M.C.Z.) and one immature shell from an old collection (M.C.Z.); Oloki Meji, Ibadan (J. C. Bridwell.-Bish.M.; M.C.Z.).

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
169 mm.	110	94	55	7½		Oloki Meji
163	96	96	53	7½		Lagos
162	94.5	94	53	7½		"
156	81.5	87	47	7½		"
150	85.5	85.5	48	7½		"
121.5	68.5	68	37	7		"
117.5	85.5	68	36	7		"
105	59	61	33	6½		"

Dr. A. Mead reports elsewhere on the anatomy of this race, which he studied on shells bought in the native market at Lagos, where the snail is commonly eaten.

c. *A. MARGINATA SUTURALIS* Philippi

Pl. 20, fig. 3; Pl. 62, fig. 5; Pl. 65, fig. 2; Pl. 72, fig. 3

- [Lister, 1688, Synopsis Method. Conchyl. Liber Quartus, Pl. 579, fig. 34].
 [Klein, 1753, Tentamen Method. Ostracologiae, p. 47 ("Urceus spec. 6"); Pl. 3, fig. 60 (a poor copy of Lister's Pl. 579, fig. 34)].
 [Petiver, 1764, Gazophylacium, 1, p. (10) of 6th Explanation of Plates; Pl. 152, fig. 11 (a poor copy of Lister's Pl. 579, fig. 34)].
Bulla achatina Huddesford, 1770, in Lister, Hist. Conch., New Edition, Pl. 579, fig. 34; and Index, 2, p. 38. Not of Linné, 1758.
Bulla achatina var. *marginata* Donovan, 1826 (May 1), Naturalist's Repository, 5, Pl. 149 (2 views of one shell; with letterpress; no locality). Not *Achatina marginata* Swainson, 1821.
Achatina marginata Reeve, 1849, Conch. Icon., 5, *Achatina*, Pl. 4, fig. 14 (West Africa).
Achatina suturalis Philippi, 1849, Abb. Besch. Conch., 3, pt. 5, p. 29 (p. 7 of *Achatina*); Pl. 2 (of *Achatina*), fig. 1 (no locality). Bourguignat, 1889, Moll. Afr. Equat., p. 78.
Archachatina (Magachatina) marginata var. *suturalis* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., 29, pt. 1, p. 81 (Southern Nigeria: Calabar; Lagos. Dahomey: Whydah. Cameroon: Ndian; Etome; Mukonje Farm; Moliwe Plantation near Victoria).
Achatina cumingii Shuttleworth, 1852, Mitth. Naturf. Ges. Bern, Nos. 248-249, p. 201 (West Coast of Africa). Pfeiffer, 1853, Monogr. Helic. Viv., 3, p. 482. H. and A. Adams, 1855, Gen. Rec. Moll., 2, p. 132. Pfeiffer, 1859, Monogr. Helic. Viv., 4, p. 601; 1868, *Op. cit.*, 6, p. 214. Haines, 1868, Cat. Terr. Shells Coll., p. 67 (Gaboon). Pfeiffer, 1876, Monogr. Helic. Viv., 8, p. 274.
Achatina (Achatinus) cumingii Pfeiffer, 1879, Nomencl. Helic. Viv., p. 265.
Archachatina cumingii Pilsbry, 1904, Man. of Conch., (2), 17, p. 112. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 66.
Achatina marginata var. *gracilior* d'Ailly, 1896, Bih. Svenska Vet.-Akad. Handl., 22, Afd. 4, No. 2, p. 61 (in part: some of the localities listed for *A. marginata* for Cameroon, but not separated from the others). O. Boettger, 1905, Nachrichtsbl. D. Mal. Ges., 37, p. 165 (Cameroon: Mukonje Farm; Johann-Albrechtshöhe near Kumba; Bakundu; Bibundi; village of Mundo on Lower Mungo River; Bakundu Kaki; Ekilliwindi; Mbanda or Mambanda; "Randgebirge" of the Interior. Egg). Spence, 1928, Jl. of Conch., 18, pt. 7, p. 213 (Southern Nigeria: Okaki, 6° 20' E.; 5° 5' N.). Not *Achatina gracilior* C. B. Adams, 1850, nor *A. m.* var. *gracilior* v. Martens, 1860.

- Archachatina marginata* var. *gracilior* Pilsbry, 1904, Man. of Conch., (2), **17**, p. 111 (description after d'Ailly, 1896; no specimen).
- Achatina* (*Archachatina*) *marginata* var. *gracilior* Germain, 1916, Ann. Mus. Civ. Genova, **47**, p. 246 (Cameroon: Buea, 800 to 1200 m. Fernando Po: Punta Frailes); Pl. 6, fig. 14 (young shell from Punta Frailes); Pl. 7, fig. 9 (adult from Punta Frailes); Pl. 10, fig. 14 (apex of young shell enlarged); 1917, Bull. Mus. Hist. Nat. Paris, **23**, p. 512 (Dahomey: Igbin). Dautzenberg, 1921, Rev. Zool. Afric., **9**, p. 94. Germain, 1926, C. R. Congrès Soc. Savantes, (1925), Sciences, p. 493.
- Archachatina marginata* var. *subsuturalis* Pilsbry, 1904, Man. of Conch., (2), **17**, p. 111 (new name for *A. suturalis* Philippi, 1849); Pl. 25, fig. 25 (after Philippi). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66.
- Achatina marginata* var. *subsuturalis* Hidalgo, 1910, Mem. Soc. Españ. Hist. Nat., **1**, No. 29, p. 508 (Spanish Guinea: Cabo San Juan).
- Achatina* (*Archachatina*) *marginata* var. *subsuturalis* Bofill and de Aguilar-Amat, 1924, Trab. Mus. Cienc. Nat. Barcelona, **10**, pt. 2, p. 7 (Fernando Po: Santa Isabel).

As Dautzenberg seems to have recognized first (1921), Lister's Pl. 579, fig. 34, copied in my Pl. 72, fig. 3, was drawn not from a specimen of the nominate race of *A. marginata*, but from subsp. *suturalis*. Lister's brief description leaves no doubt about this: "Cochlea ventricosior, fasciis ex nigro purpurascens, ad tergum certe undatis, ipsa columella purpurascens." The figure is too broad for *A. purpurea*, too smooth for *A. ventricosa*, and with too narrow an aperture for *A. degneri*. It was copied, but very crudely, by Klein and Petiver.

Original description of *A. suturalis* Philippi (1849): "A. testa ovato-conica, crassiuscula, in anfractibus superioribus tenuissime decussato-granulata, in ultimis laevissima, sub epidermide fulvo-lutea ad apicem purpurea, deinde alba, strigis crebris angustis, undulatis castaneis ornata; spira conica, acutiuscula; sutura marginata, haud crenulata; anfractibus septem, parum convexis, ultimo spiram longe superante; columella callosa, purpurea, breviter et abrupte truncata; apertura ovato-oblonga intus alba, labro intus nigricante, recto, in parte basali arcuato. Long. 42''' [=91.5 mm.]; lat. 26''' [=56.5 mm.]" The following additional notes are translated from the German: "As appears from the foregoing diagnosis, *A. suturalis* differs from the very similar *A. zebra* in the red apex, the marginate and not crenulated suture, the longer body-whorl as compared to the spire, and the red columella. My shell has 7 whorls, the upper 4, which form the rounded apex, being finely reticulate granulose and red. With whorl 4 appear the dark brown markings and the impressed line, which marginates the suture, devoid of crenulations. The lower whorls are white, with crowded, wavy, longitudinal dark brown streaks, occasionally broken

up into dots. These later whorls are all slightly convex and much higher in proportion to the width than in *A. zebra*, this being particularly true of the body-whorl, which is one and one-half times as long as the spire. The shape of the aperture is not peculiar, but the columella is shorter than in *A. zebra*, broader and more strongly curved, bright red as in *A. perdix*. *A. suturalis* differs from *A. perdix* very decidedly in the more obtuse red apex, the entirely smooth terminal whorls, the different proportion of the whorls, the coloration, etc." The present location of the type is unknown. To judge from the figure, copied in my Pl. 65, fig. 2, it was an immature-shell. The name *suturalis* need not be changed. The earlier *Achatina suturalis* Pfeiffer (1848) is not a true or primary homonym, but merely a new combination for *Polyphemus suturalis* Pfeiffer (1839), a shell not now placed in *Archachatina* nor in the family Achatinidae.

Reeve's (1849) Pl. 4, fig. 14, shows a fully adult *suturalis*, with reddish summit and columella, 118 mm. long, 72 mm. wide, with the aperture 65 by 38 mm. It is about average size for this race.

Original description of *Achatina cumingii* Shuttleworth (1852): "Testa ovato-oblonga, solida, striata, lineis punctatis obsolete decussata, sub epidermide flavido-albida strigis latis fuscis vel nigro-castaneis in anfractu ultimo basi confluentibus ornata; spira ovata, apice obtusa, rosea; anfr. 6, convexiusculi, ultimus fere $\frac{5}{8}$ longitudinis aequans, vix inflatus; sutura marginata; columella arcuata, basi roseo-tincta, oblique truncata; apertura semiovalis, intus margaritacea; perist. simplex, rectum, subincrassatum, marginibus callo nitido albido junctis. Long. 77; Diam. 40 mill.: Apert. 40 mill. longa, 26 lata. Specimina 2 examinavi. Affinis *Ach. suturali* Phil. (*A. marginata* var. columella rosea auct.) sed gracilior, columella magis arcuata et testa multo minus inflata distincta." The two cotypes, none of which has ever been figured, should be at the Bern Museum. There seems to be no difficulty in recognizing from the description that *cumingii* was based on an immature, hence more slender *A. marginata suturalis*.

A. marginata var. *gracilior* v. Martens (1860), renamed *Archachatina marginata* var. *eduardi* by Pilsbry (1909), has been generally regarded thus far as a form with red columella, following d'Ailly's interpretation of v. Martens' account. As shown below, it was rather a small, slender race with whitish columella. Most of the specimens later referred to *gracilior* appear, however, to have been *A. marginata suturalis* (Philippi). d'Ailly's (1896) account of *marginata* and var. *gracilior* is not very clear. He says at first: "The second form, which seems to be the one cited by v. Martens as a variety (Monatsber., 1876), = var. *gracilior* v. Martens (Albers, Hel., 1860), is without violaceous color.

..."¹ But on the same page below he states: "All the specimens belonging to the variety have the columella colored either deep carmin-rose or reddish-yellow, even to almost golden-tinged." From this it would seem that some of the shells at any rate, included by d'Ailly under var. *gracilior* were *suturalis*, although he did not separate their localities from those of typical *marginata* with a whitish columella. Pilsbry's (1904) description of *gracilior* was not based on specimens, but apparently on d'Ailly's account, since he emphasizes "the columella intense rose or reddish golden". O. Boettger (1905) also followed d'Ailly's interpretation, for he says (p. 166) that a pale unicolorous shell from Bibundi has a beautifully fleshy-red apex and columella and "is therefore var. *gracilior* v. Martens."² Germain's specimens of *gracilior* (1916 and 1917) were likewise *A. m. suturalis*, since the reddish columella is clearly mentioned in his discussions. As for Spence's (1928) *gracilior*, which he merely says to be "a richly coloured form", it is difficult to decide what it may have been, although the probability is for *suturalis*. Possibly some of the shells called *gracilior* by Germain and Spence were *A. papyracea* (= *adclinae*).

Donovan's (1826) two figures of *Bulla achatina* var. *marginata*, one of which is reproduced in my Pl. 62, fig. 5, although somewhat distorted, are nevertheless recognizable. The larger of the two shows the shell in front view, with the reddish apex and columella of subsp. *suturalis*, which are also mentioned in the brief accompanying description (English text only copied): "Shell ovate-oblong, ventricose, tip rosy, fulvous with longitudinal chestnut-coloured waves: pillar lip violet purple: lip within white."

According to O. Boettger's (1905) measurements, the egg of subsp. *suturalis* is slightly smaller than that of the nominate race, being 17.5 to 18 mm. long and 13 to 13.5 mm. wide. One egg which I found in a dead *suturalis* from Mukonje Farm, was 18 mm. long, 13.5 mm. wide.

Specimens Examined. "West Africa" (U.S.N.M.). — DAHOMEY: Whydah (Brus.M.). — SOUTHERN NIGERIA: Old Calabar (M.C.Z.); Lagos (A. R. Mead.-M.C.Z.; Hamb.M.). — CAMEROON: Edea (G. Schwab.-M.C.Z.); Ndian (Y. Sjöstedt.-Stockh.M.; M.C.Z.); Etome (P. Dusén.-Stockh.M.; M.C.Z.); Moliwe Plantation near Victoria (Berl.M.; M.C.Z.); Mukonje Farm (R. Rohde.-Frankf.M.; M.C.Z.). — FRENCH CONGO: Gaboon (A.M.N.H.; M.C.Z.).

Subsp. *suturalis* is also known definitely from Spanish Guinea and Fernando Po.

¹ "manque de la couleur violette," in the French original. In this quotation I have inserted the years so that the reader may trace the references in my bibliographies. It should be noted that the variety described and figured by v. Martens in 1876 appears to be *A. marginata egregia* Dautzenberg, not *A. marginata suturalis*.

² "also zur var. *gracilior* v. Mts. gehörig," in the German original. This Bibundi shell was, however, *A. marginata grevillei* (Pfeiffer).

Measurements of Adult Shells

Greatest		Aperture		Whorls	
Length	Width	Length	Width		
134.5 mm.	82.5	78	45	7	Lagos
130	78	78	43	7	“West Africa”
127	71	80.5	39	6½	Ndian
115.5	71	70.5	40	6½	Lagos
114	66	67	34	7	Old Calabar
108	55	57	30	6⅓	Gaboon
106	59	59	32	6½	Lagos
105	59	62	30.5	6½	Old Calabar
101.5	59.5	57.5	33.5	6½	“
90	50	54.5	28.5	6	Etome
72.5	41.5	39	22.5	6	Old Calabar

It may be seen that subsp. *suturalis* is on the average smaller than the nominate race, being usually about 110 mm. long and 60 mm. wide. Immature shells of this race are often more slender and lighter than nominate *marginata* of about the same age; but these differences tend to disappear with age.

d. *A. MARGINATA* EDUARDI Pilsbry

Pl. 55, fig. 1

Achatina marginata var. *gracilior* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., pp. 201 and 203 ("Axim in Südafrika"; Axim is in the Gold Coast). Pachtel, 1889, Cat. Conch.-Samml., 4th Ed., 2, p. 240. Not *Achatina gracilior* C. B. Adams, 1850.

Archachatina marginata var. *gracilior* Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 66.

Achatina modestior O. Boettger, 1905 (November 1), Nachrichtsbl. D. Malak. Ges., 37, p. 167 (Cameroon: in part; only the variety from Bibundi; not the holotype from Mukonje Farm); Pl. 7, fig. 3 (variety from Bibundi). Bequaert and Clench, 1938, The Nautilus, 52, p. 27 (Cameroon: Bibundi, paratypes; Moliwe Plantation near Victoria).

Archachatina marginata var. *eduardi* Pilsbry, 1909, Man. of Conch., (2), 20, p. 113 (new name for *A. marginata* var. *gracilior* v. Martens, 1860).

Achatina marginata var. *fourncaui* Spence, 1928, Jl. of Conch., 18, pt. 7, p. 213 (Southern Nigeria: Ogobo). Not of Germain, 1908.

Archachatina (Megachatinops) adclinae Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., 19, pt. 1, p. 87 (in part: specimens from Cameroon: Bibundi and Moliwe Plantation). Not of Pilsbry, 1905.

v. Martens' (1860) description of his *A. marginata* var. *gracilior* is rather confused (translated here from the German): "Reeve, Con-

chol. Icon. fig. 14 figures this species [= *marginata*] also with red columella and red apex. The specimen in Albers' collection likewise has a reddish apex. The most essential differences [of *marginata*] remain the smooth surface, the blunt apex, the broader angle at the junction of the outer lip [with the parietal wall], and the slight thickening followed by an expansion of the outer lip. All these characters are also present in a second, smaller and much more slender example in Albers' collection, only 110 mm. long, 50 mm. in diameter, with the aperture 60 by 35 mm. A comparison of the upper whorl [= body-whorl] with that of usual *marginata*, as well as the expanded and slightly thickened margin of the mouth, preclude its being regarded as not full-grown. In accordance with the slender shape, the columella is also but weakly curved. I have therefore listed it above as var. *gracilior*." It should be noted that the color of the columella and apex of this slender specimen is not mentioned. v. Martens discusses three different specimens: (1) The shell figured by Reeve (1849), Pl. 4, fig. 14, which has a red columella and is *A. m. suturalis*. (2) A shell in Albers' collection, with a reddish apex, but of which he does not describe the columella. Possibly this was *A. m. suturalis*, although I have seen examples of the nominate race of *marginata* with a decidedly pink summit. (3) A second shell in Albers' collection, of which he does not describe the color of the apex and columella, but which he says was smaller and more slender than Albers' first shell. To this second shell only he gave the name var. *gracilior*. The intervening sentence, about the essential differences, merely enumerates what he regards as the most characteristic features common to all forms or races of the species *A. marginata*, regardless of the color of apex and columella. For this reason I assume that the "second shell" from Albers' collection was of the smaller, more slender race with whitish columella. The present whereabouts of this shell, the type of v. Martens' *gracilior*, is unknown. It was not found at the Berlin Museum in 1933, but might have been overlooked, perhaps because it was not properly labelled. Whether the type had actually been found alive at Axim is doubtful, since no other specimen of *eduardi* has been taken that far West for nearly a century.

As v. Martens' *gracilior* is a primary homonym of *Achatina gracilior* C. B. Adams (1850), it was renamed *eduardi* by Pilsbry (1909), a name here adopted for the small subspecies of *A. marginata* with whitish columella.

Most, if not all, of the shells later referred by d'Ailly (1896), O. Boettger (1905), Germain (1916; 1917), and Spence (1928) to *gracilior* were *A. marginata suturalis* (Philippi), as I have pointed out in the discussion of that race.

O. Boettger (1905) confused two species in his original account of *A. modestior*; but the main description and the figures of the holotype from Mukonje Farm (Pl. 7, figs. 1-2) were based on *Archachatina papyracea* (Reeve) (= *A. adclinae* Pilsbry), where *modestior* will be discussed. The variety from Bibundi, shown in his Pl. 5, fig. 3, as well as other "paratypes" from the same locality, which I have seen, were, however, *A. m. eduardi*. Of this form he says: "A single shell from Bibundi, probably a variety of it [= *A. modestior*], is rather peculiar by the striking, strongly S-shaped curved columella, the deeper suture and the color and pattern. It may be defined as follows: Differt a typo t. minore, strigis multo latioribus, magis obscuris, latioribus quam interstitia, simplicibus, nullo modo fulguratis sed interstitiis hic illic brunneo punctatis, in anfr. ultimo supra et infra medium subaequalibus, prope columellam superne profunde concavam et validissime tortam subiti evanidis; apert. intus pallide violacea; columella albida. Alt. 65, diam. max. 39 mm.; alt. apert. 36, lat. apert. 24 mm. I do not want to give this example a name as it almost looks like an abnormality, because of a repaired injured area at the suture of the fourth whorl and the unusual shape of the columella."

Specimens Examined. "West Africa" (M.C.Z.; U.S.N.M.). — CAMEROON: Moliwe Plantation near Victoria (v. Maltzan.-Berl.M.; M.C.Z.); Bibundi, paratypes of "*modestior*" (R. Rohde.-Frankf.M.; M.C.Z.). — FERNANDO PO: Bantabury Plantation (A. Green.-M.C.Z. ex Connolly Collection).

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
101.5 mm.	54	61.5	30	6 $\frac{1}{3}$		"West Africa"
86.5	48.5	50	26	6		" "
86	50	52.5	29	6		Bibundi
84.5	49	49.5	27.5	6		Moliwe
80.5	48	46.5	27	6		"

A shell at U.S.N.M. (No. 516847), labelled Assinie, Ivory Coast, appears to be a dwarfed *A. m. eduardi*. It is 66.5 mm. long, 37 mm. wide, of $5\frac{3}{4}$ whorls, with the aperture 38.5 by 21 mm. Though not quite full-grown, it is narrower than other *eduardi* of approximately the same age. It resembles somewhat the dwarf variety (paratype) of *modestior* of O. Boettger's Pl. 7, fig. 3. The locality Assinie is open to question, there being no other reliable record of any race of *marginata* from West of Dahomey. Mr. T. Pain recently sent me a similar shell, with strongly concave columella, equally slender, but larger though

immature, from Fernando Po, 76 mm. long, 40 mm. wide, of nearly 6 whorls, with the aperture 41.5 by 20.5 mm. Both shells have a bluish-white columella.

e. *A. MARGINATA EGREGIELLA* Bequaert and Clench

Pl. 62, fig. 1

Archachatina (Magachatina) marginata var. *egregiella* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 83; Pl. 1, fig. 3 (Cameroon: Kribi).

Original description of *A. marginata* var. *egregiella* Bequaert and Clench (1936): "Agrees in general type of coloration with var. *egregia*, but the first three whorls are vinaceous-red like the columella and the outer lip is broadly margined inside with the same vinaceous color. In the single, probably immature type, the columella is nearly straight and the aperture is much narrower than in *egregia*. Length, 80 mm.; greatest width, 47.2 mm.; $5\frac{1}{2}$ whorls."

This form is known thus far only from the holotype (M.C.Z. No. 73135), in which the aperture is 45.5 mm. long and 23.5 mm. wide.

f. *A. MARGINATA EGREGIA* (Dautzenberg)

Pl. 54, fig. 2; Pl. 71, fig. 2

Achatina marginata var. v. Martens, 1876, Monatsber. Ak. Wiss. Berlin, p. 257; Pl. 2, fig. 1 (animal. Cameroon: Victoria. The figure shows the lower half of the body-whorl entirely dark brown and the columella is said to be reddish).

Achatina (Archachatina) marginata var. *egregia* Dautzenberg, 1921, Rev. Zool. Afric., **9**, p. 95; Pl. 6, fig. 3 (Cameroon: Yaunde, at 750 m.).

Archachatina (Magachatina) marginata var. *egregia* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 83 (Cameroon: Yaunde; Bitye; Lolo-dorf; Metet; Kribi in Pangwe District).

Achatina marginata var. *nigrofasciata* "Thiele" Tessmann, 1913, Die Pangwe, **2**, p. 270 (Cameroon: Pangwe District; without description). *Nomen nudum*.

Original description of *A. marginata* var. *egregia* Dautzenberg (1921) (translated from the French): "In shape this variety is close to typical *A. marginata*, but the whorls are more convex and the body-whorl is more swollen in the upper part. Its microscopic sculpture is finer, more distinctly granulose. The var. *egregia* is remarkable especially for its coloration; the columella is bright carmine-red and the early whorls are

reddish. The spire and the upper half of the body-whorl have dark-brown flammules on a white background covered with a golden-yellow periostracum. The lower half of the body-whorl is distinctly divided from the upper portion by a broad black band which descends to a short distance from the base, where it borders a white area surrounding the columella. In the var. *gracilior* [*A. marginata suturalis* Philippi], the columella is red and the summit of the spire reddish, as in var. *egregia*, but there is no dark band on the body-whorl and the longitudinal vertical brown flammules descend to the base. Some years ago, Mr. Chaper brought us from his journey to Assinie numerous *A. marginata* in which the lower half of the body-whorl is darker than the upper half, but this color is not very dark, does not hide the brown flammules that cross it and does not extend to the base of the shell." The type was presumably figured natural size, being then 96 mm. long, 58 mm. wide, with the aperture 59 by 33 mm. The original figure is copied in my Pl. 54, fig. 2. The type should have been in Dautzenberg's own collection and therefore should now be at the Brussels Museum; but I failed to see it in 1933.

The first mention of this striking color form was by v. Martens in 1876, but he did not name it. In 1913 Tessmann mentions a var. *nigrofasciata* "Thiele" from the southern Cameroon. Specimens thus labelled in Thiele's handwriting, were seen at the Berlin Museum in 1933 and referred to var. *egregia* by Bequaert and Clench (1936). These authors also noted that some shells of *egregia*, from Bitye, at the British Museum and elsewhere, bear a manuscript specific name (by Preston), meaning "festive."

Subsp. *egregia* is characterized by the broad dark chestnut-brown or nearly black transverse band which occupies most of the lower two-thirds of the body-whorl, beginning at the periphery and leaving only a narrow columellar area straw-colored. Upper part of body-whorl with relatively few chestnut wavy streaks or spots. Inner margin of columella vinaceous-red. Apex of spire pale yellowish or more or less roseate. Outer lip bluish-white inside over the paler, and darker bluish over the brown area.

An interesting variant of *egregia*, from Lolodorf, is fairly uniformly straw-yellow, with a few narrow, widely spaced pale brown vertical streaks on the penultimate and the upper part of the body-whorl; below the periphery the body-whorl is at first streaked like the upper part; but in the terminal half it has a fairly distinct, very pale brown, darkened band, sharply set off in the usual manner from the straw-yellow base. Apical four whorls roseate. Columella and most of parietal wall intensely violaceous-red. Inner edge of outer lip white. Shell seemingly full-grown, with slightly expanded outer lip, but small:

81 mm. long, 51 mm. wide, of 6 whorls, with the aperture 47.5 by 26 mm.

Specimens Examined. CAMEROON: without precise locality (Leid.-M.); Yaunde (Ac.N.S.Phila.); Bitye (Brit.M.); Lolodorf (A. I. Good.-Carn.M.; M.C.Z.; Ac.N.S.Phila.); Bipindi (M.C.Z.; M.U.Mich.); Ebolowa (E. D. Horner.-M.C.Z.); Ntem (Miss E. M. Daniels.-M.C.Z.); Efulen (M.C.Z.; M.U.Mich.; Ac.N.S.Phila.); Metet (A. I. Good.-Carn.M.; M.C.Z.; Brit.M.; Ac.N.S.Phila.); Pangwe District (G. Tessmann.-Berl.M.); Bafia, at edge of forest in North Central section (E. D. Horner.-M.C.Z.).

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
111 mm.	65	63	34.5	6 $\frac{1}{3}$		Metet
110	67	63.5	37	6 $\frac{1}{3}$		"
103	65	62	37	6		Yaunde
89	52	52	28	6		Lolodorf
84	50	49	26.5	6		"

Subsp. *egregia* evidently is smaller when full-grown than the nominate race of *A. marginata*. Dautzenberg's type was about average.

g. *A. MARGINATA* CLENCHI, new subspecies

Pl. 14, fig. 2

Agrees with *egregia* and *egregiella* in the color pattern, having the same broad blackish-brown band over the lower half of the last whorl, sharply divided from the straw-yellow base. The dark band is, however, most complete behind the outer lip, being elsewhere more or less interrupted by vertical pale yellow streaks. Summit pale colored or slightly roseate. Columella, parietal wall and inner edge of outer lip bluish-white, without any trace of violaceous. Most specimens seen are immature. The largest and more nearly adult, chosen as the holotype, has the dark band somewhat broken up in front. This form is mainly of interest as showing the evident connection of *egregia* and *egregiella* with subsp. *eduardi*. All four subspecies are similar in size and shape.

Specimens Examined. CAMEROON: Edea, holotype (G. Schwab.-M.C.Z. No. 167946) and 4 paratypes (G. Schwab.-M.C.Z. No. 153150); Sakbayeme, paratype (G. Schwab.-M.C.Z. No. 166380).

Measurements of Holotype

Length	Greatest	Aperture		Whorls	Edea
	Width	Length	Width		
96.5 mm.	57	56	29	6 $\frac{1}{3}$	

h. *A. MARGINATA GREVILLEI* (Pfeiffer)

Pl. 81, fig. 5

Achatina grevillei Pfeiffer, 1860, Proc. Zool. Soc. London, (for 1860), p. 138 (Southern Nigeria: Old Calabar); 1861, Malak. Blätt., 8, p. 78 (more complete description); 1868, Monogr. Helic. Viv., 6, p. 213; 1876, *Op. cit.*, 8, p. 274. Pachtel, 1889, Cat. Conch.-Samml., 4th Ed., 2, p. 239.

Achatina (Achatinus) grevillei Pfeiffer, 1879, Nomencl. Helic. Viv., p. 265.

Archachatina grevillei Pilsbry, 1904, Man. of Conch., (2), 17, p. 112.

Archachatina grevillei Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 66.

Archachatina (Magachatina) marginata var. *grevillei* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., 29, pt. 1, p. 81 (holotype and another specimen from Old Calabar).

Achatina marginata, albino variety, O. Boettger, 1905, Nachrichtsbl. D. Mal. Ges., 37, p. 166 (in part. Cameroon: specimen from Bibundi, said to have the apex and columella colored as in *suturalis*; the other albino specimens from Johann-Albrechtshöhe and Mukonje Farm appear to have had a white columella and were therefore of subsp. *candefacta*).

Original description of *A. grevillei* Pfeiffer (1860): "T. ovato-oblonga, solida, striatula, sub epidermide tenui, fuscula olivaceo-lutescens; spira conica, obtusa; sutura crenulata, late impresso-marginata; anfr. 6-7, supremi minutissime decussati, ultimus spiram superans, sublaevigatus, peripheria obsolete angulatus; columella subtorta, purpurea, anguste truncata; apertura parum obliqua, angulato-ovalis, intus margaritaceo-albida; perist. tenue, expansiusculum, marginibus callo purpureo, sursum pallidiore, junctis, dextro repando. Long. 105, diam. 55 mill." In 1861 Pfeiffer added that the aperture is 66 mm. long and 36 mm. wide. In 1933 I saw the type, of the Cuming Collection, at the British Museum. It is now figured for the first time (Pl. 81, fig. 5). It is the albino form of *A. marginata* with violaceous parietal wall and columella. It should be noted, however, that the columella of the type is now only partly roseate to vinaceous-red. It is one of the smaller specimens of the species, but fully adult, as shown by the number of whorls and the expanded outer lip.

Specimens Examined. SOUTHERN NIGERIA: Old Calabar, holotype (Brit. M.) and a similarly colored shell (Berl. M.). — Also an additional example from "West Africa" at Brit.M.

i. *A. MARGINATA ICTERICA* Bequaert and Clench

Pl. 26, fig. 1; Pl. 75, fig. 1

Archachatina (*Magachatina*) *marginata* var. *icterica* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 81 (Gaboon).

This form was originally described from an immature shell, from the Gaboon (holotype, M.C.Z. No. 45526), as "uniformly straw-yellow, also at apex, without any indication of streaks or spots. The interior of the aperture and upper part of the columella are slightly bluish." The type was 89.5 mm. long, 58 mm. in greatest width, of $5\frac{1}{2}$ whorls, the aperture 60 by 32.5 mm. I have since seen two fully adult specimens, with expanded outer lip, also labelled "Gaboon," likewise straw-yellow, including the apex; but one of them shows faint traces of very pale brown, wavy vertical streaks. In all the aperture inside, the inner edge of the outer lip, the columella and the parietal wall are nearly white or very slightly tinged with blue. I figure both the holotype and one of the adults.

Measurements of Adult Shells

Length	Greatest	Aperture		Whorls	
	Width	Length	Width		
136 mm.	89	86	47	7	Gaboon
127.5	86	81.5	45	7	"

j. *A. MARGINATA CANDEFACATA* Bequaert and Clench

Pl. 74, fig. 2; Pl. 77, fig. 3

Archachatina (*Megachatinops*) *adelinae* var. *candefacta* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **19**, pt. 1, p. 87 (Cameroon: Johann-Albrechtshöhe).

Archachatina modicstior var. *candefacta* Bequaert and Clench, 1938, The Nautilus, **52**, p. 27.

Achatina marginata, albino variety, O. Boettger, 1905, Nachrichtsbl. D. Mal. Ges., **37**, p. 166 (in part. Cameroon: specimens from Johann-Albrechtshöhe near Kumba, one of this lot being the holotype of *candefacta*; possibly also specimens from the Mukonje Farm).

Original description: "Differs from typical *adelinae* in the complete absence of dark markings. First four whorls pale orange-yellow, the remainder of the shell unicolorous straw-yellow; inside of the aperture and columella pure white. Shape and sculpture as in the typical

form." The holotype (M.C.Z. No. 79972), is 76.8 mm. long, 43 mm. wide, of 6 whorls, the aperture 46.9 by 23 mm. This form was at first erroneously referred to *A. adclinae*. Subsp. *candefacta* has the characteristic "weave" microsculpture of *marginata*, of which no trace is to be found in *papyracca* (= *adclinae*).

In addition to the holotype, possibly not fully adult, the M.C.Z. now has also another specimen, apparently full-grown, but unfortunately labelled "West Africa" only. It exceeds the type but slightly in size. Subsp. *candefacta* is clearly a dwarfed *A. m. icterica*, but is in proportion slightly narrower than the latter.

Measurements of Adult Shell

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Length		
84 mm.	49	48	32	6½		"West Africa"

ARCHACHATINA (CALACHATINA) VENTRICOSA (Gould)

a. Typical *A. VENTRICOSA*

Pl. 6, fig. 3; Pl. 8, fig. 2; Pl. 9, fig. 2; Pl. 10, fig. 3;

Pl. 22, fig. 3; Pl. 23, fig. 3; Pl. 45, fig. 1; Pl. 73, figs. 1-2

Helix (*Cochlitoma*) *marginata* Rang, 1831, Ann. Sci. Nat., **24**, p. 33 (in part: specimens from Coast of Malaguette [=Liberia] and Ivory Coast; not the description). Not of Swainson, 1821.

Achatina marginata Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 249 (in part: records from Coast of Malaguette and Ivory Coast). Not of Swainson, 1821.

Achatina purpurca Philippi, 1849, Abb. Besch. Conch., **3**, pt. 5, p. 30 (p. 8 of *Achatina*) (shell used for comparison with his *A. rhodostoma*). Not of Gmelin, 1790.

Achatina ventricosa Gould, 1850 (April), Proc. Boston Soc. Nat. Hist., **3**, p. 195 (Liberia, in the interior; although no precise locality was given, the specimens were part of a lot of shells collected in the Cape Palmas area by Dr. George A. Perkins); 1862, Otia Conchologica, p. 208. (Anonymous), 1875, 27th Ann. Rept. New York State Mus., (for 1873), p. 51 (Gould's type). Boucard, 1901, Cat. Coll. Coq. Terr., p. 50.

Archachatina ventricosa Pilsbry, 1905, Man. of Coneh., (2), **17**, p. 113 (Ivory Coast: Taboo.¹ Liberia: Cape Palmas); Pl. 21, fig. 6 (full-grown specimen from Cape Palmas); Pl. 23, fig. 19 (immature specimen from Taboo). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 67.

¹ The locality Taboo, now in the French colony of the Ivory Coast, is only some 30 miles East of Cape Palmas.

Archachatina (Magachatina) ventricosa Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., 29, pt. 1, p. 85 (Liberia: Camp No. 3 on Du River; Paiata; Suah Koko; Bolahun; Cape Palmas. Ivory Coast: Taboo); Pl. 2, fig. 13 (specimen from Taboo at Ac.N.S.Phila.).

Gould's original description is as follows: "Testa magna, solida conico-ovata, ex corneo virescente, longitrorsum obscure flammulata, granoso-reticulata; spira conica, anfr. $6\frac{1}{2}$ convexis, ultimo ventricosus, obtuse carinato; sutura subcrenulata; apertura rotundato-ovata $\frac{3}{5}$ long. testae adequante; labro everso intus incrassato, submargine et columella nitide purpureis; columella valde arcuata. Long. 5 [=127 mm.]; lat. $3\frac{1}{2}$ poll. [=89 mm.]; aperturae long. 3 [=76 mm.]; lat. $1\frac{3}{4}$ poll. [=45 mm.]. Closely allied to *A. purpurea*, but the form is constantly more ventricose, and by comparing an extensive series, including the young, the difference is plainly not accidental. The color is more mixed with green and less conspicuously flammulated, and often flecked with triangular pale spots, and the aperture more of a blood red." I have seen the only definitely known type specimen now extant in the Gould Collection, as it was bought by the New York State Museum at Albany, New York, in 1863 (lot No. 187). This shell, at present on temporary loan at the M.C.Z., is here figured for the first time (Pl. 22, fig. 3). It is much smaller than Gould's measurements, being only 109 mm. long, 70 mm. in greatest width, of $6\frac{1}{3}$ whorls, the aperture 65 by 37 mm. It is, moreover, immature and does not have the thickened and expanded outer lip mentioned in Gould's description. Nevertheless it is easily matched with some of the specimens I collected in Liberia. Gould evidently gave the measurements of the largest of his several specimens, which was in fact close to the record size of the species. He considered all his shells as cotypes, distributing them freely to other collectors and keeping only the smaller, immature one in his own collection. One of the larger shells at the M.C.Z., now merely labelled "West Africa", comes so close to Gould's original measurements that it might well have been the one he measured. Its history is unfortunately unknown.

When in perfect condition, the shell is a dirty, dark or light olivaceous-yellow, with the summit yellowish or roseate, sometimes with a spiral pale brown line at the periphery of the last whorl, and with vertical dark chestnut-brown streaks at irregular intervals, particularly on the early whorls; in addition it is often sparsely speckled with irregularly distributed dark spots. The periphery is often very obtusely carinate, particularly in immature shells. The nepionic whorls of young shells are densely covered with medium-sized granulations in regular spiral and vertical rows. On the post-nepionic whorls the

granulations become gradually coarser, but less regular, being developed even below the periphery on full-grown shells. On the body-whorl the sculpture is distinct to the eye without magnification and easily felt by touch. The color of aperture inside, columella and parietal wall in fresh adult shells varies from violaceous pink to salmon pink, but is often faded in part; the inner edge of the outer lip is violaceous-black and a narrow violaceous-black streak often borders the outer side of the parietal violaceous area. The last three whorls are deeply depressed and margined by a line below the suture. The shell is very broadly oval, with a long and swollen body-whorl, rather sharply set off from the short, narrow spire. The aperture, though broadly semi-elliptical to nearly semi-circular, is relatively longer for its width than in *A. purpurea*, which, moreover, in fully adult shells is decidedly narrower than *A. ventricosa*. The granulose sculpture of the nepionic whorls is almost always completely worn off in fully adult living snails. The smallest young shell seen, 23.5 mm. long, of $3\frac{3}{4}$ whorls, has the early whorls granulose, except for the wrinkled first; it also has a deep, open umbilical slit.

Pfeiffer (1853, Monogr. Helic. Viv., 3, p. 484; 1859, *Op. cit.*, 4, p. 601; 1868, *Op. cit.*, 6, p. 213; 1876, *Op. cit.*, 8, p. 273; 1879, Nomencl. Helic. Viv., p. 265) treated *ventricosa* as a synonym of *A. rhodostoma*, at first doubtfully, later definitely. Pilsbry (1905) recognized it as distinct from both *rhodostoma* and *purpurea*. I have reached the same conclusion from a study of numerous specimens, mostly gathered by myself in several Liberian localities over a wide area. I cannot, however, attach much importance to the supposed difference in sculpture between *ventricosa* and *purpurea*. Moreover, it is sometimes difficult to decide whether a given specimen is a very large *purpurea* or an immature or dwarfed *ventricosa*.

Specimens Examined. SIERRA LEONE: Njala, Dasse Chieftdom, Moyamba District (T. S. Jones.—M.C.Z.). — LIBERIA: without more precise locality (M.C.Z.; U.S.N.M.); Harbel (Firestone Plantation) on the Du (or Dukwa) and Farmington Rivers; Suah Koko; Dobli Id.; Sanoyea; Paiata; Zuodumai; Jenne; Sodu; Degei; Zorzor; Popolahun; Bolahun; Kasia; Kailahun; Pandamai; Nyandamolahun; Bondualahun; Sardu Pascia; Vasala; Foyakamara (all collected by J. Bequaert.—M.C.Z.); Bolahun (E. Maass.—Hamb.M.); Ganta (G. W. Harley.—M.C.Z.); Cape Palmas (M.C.Z.; U.S.N.M.; Ac.N.S.Phila.). — IVORY COAST: Taboo (Ac.N.S.Phila.); Grand Bassam (M.C.Z.); Assinie (Chaper.—Terv.M.). — Also several merely labelled "West Africa" (M.C.Z.; Ac.N.S.Phila.).

A. ventricosa is known at present only from southeastern Sierra Leone (about $12^{\circ} 10' W.$, $8^{\circ} 5' N.$), Liberia, where it is one of the most

common snails, and the Lower Ivory Coast (as far East as 3° 15' W.). It is commonly eaten by the autochthonous Liberian natives. The egg is regularly ellipsoidal, 16 to 17 mm. long and 12 to 12.5 mm. wide.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Length		
128 mm.	81	80	44	6½	West Africa	
126	86	74	47.5	6½	"	
118.5	76	75	41.5	6½	Grand Bassam	
115	78	69	44.5	6½	Cape Palmas	
114	76	73	40	6¼	West Africa	
110.5	68	69	40	6	Harbel	
109	74	72	41	6	Degei	
103	66	65	36	6	Cape Palmas	
100.5	61.5	57	35	5½	West Africa	
98.5	62	63	33	5½	Sardu Pascia	
95	63	61	34	5½	Degei	
92	60	59	33	5½	Vasala	
88	57.5	51.5	29.5	5½	West Africa	
85	57	56	31	5½	Cape Palmas	

b. *A. VENTRICOSA SPECTACULUM* Pilsbry

Pl. 18, fig. 1; Pl. 25, fig. 3; Pl. 46, fig. 1; Pl. 49, fig. 1; Pl. 60, fig. 3; Pl. 61, fig. 5; Pl. 75, fig. 4

[The Heirs of G. W. Knorr, 1769, Vergnügen der Augen und des Gemüths, 4, p. 39; Pl. 24***, fig. 1 (front view of a polished shell from the Schadeloock Collection); 1770, Délices des Yeux et de l'Esprit, 4, p. 44; Pl. 24***, fig. 1; 1773, Verlosting der Oogen en van den Geest, 4, p. 24; Pl. 24***, fig. 1].

Bulla achatina P. L. S. Müller, 1775, in Linné, Vollständ. Natursyst., 6, pt. 1, p. 414 (both description and citation of Knorr, Pl. 24***, fig. 1, refer this to *A. ventricosa spectaculum*). Shaw and Nodder, 1800, Naturalist's Miscellany, 12, Pl. 438 (with date on Plate; error for Pl. 447; var. "with blue variegations and crimson mouth" and reference to Knorr, Pl. 24***, fig. 1, of which Pl. 438 is a copy). Not of Linné, 1758.

Achatina purpurea Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., 2, pt. 2, p. 161 (in part), and Explanation of Plates, p. 17; Atlas, Pl. 123, figs. 1-2 (2 views of one shell; Plate published after Férussac's death, presumably in 1851); 1863, in Maillard, Notes Ile Réunion, 2d Ed., 2, Annex E, p. 90 (with reference to Férussac's Pl. 123, figs. 1-2; listed by error among the mollusks of Réunion). Not of Gmelin, 1790.

Archachatina spectaculum Pilsbry, 1933, Proc. U. S. Nat. Mus., 72, Art. 19,

p. 2 (holotype from "West Africa"; paratype from Gambia); Pl. 2, fig. 4 (holotype).

Archachatina (*Megachatinops*) *spectaculum* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 95.

Pl. 24***, fig. 1 of the work published by Knorr's Heirs, after his death, shows a polished shell, which for shape and color could be either *A. degneri* or *A. ventricosa*. The accompanying text is meaningless and scarcely describes the figured shell. The oblique cross-lines of the figure may represent the decussate sculpture, distinct in *ventricosa*, very weak in *degneri*. Moreover, the narrow blackish inner edge of the outer lip and of the left margin of the parietal wall, shown in the figure, are frequent features of *ventricosa*, which I have not observed in any of the fairly many *degneri* seen. Knorr's figure, reproduced in my Pl. 61, fig. 5, is much too broad for *purpurea*. It is 117 mm. long, 75 mm. in greatest width, with the aperture 68 by 42 mm. In general shape it agrees best with what I here regard as subsp. *spectaculum*. Shaw and Nodder's Pl. 438 is so similar to Knorr's figure, that it is clearly a copy (see my Pl. 49, fig. 1).

Deshayes' Pl. 123, figs. 1-2 seem to be good representations of *spectaculum* and agree closely with some of the specimens at M.C.Z. which I refer to this race. The shell is much too wide for true *purpurea*. It measures on the figures 98 mm. in length, 63 mm. in greatest width, with the aperture 55 by 30 mm. One of Deshayes' figures is copied in my Pl. 75, fig. 4.

Original description of *Archachatina spectaculum* Pilsbry (1933): "The solid, ovate-conic shell is between olive-ochre and honey-yellow, with straight, widely spaced, brown and light brownish-olive streaks, the spire whitish to pale brown with darker brown irregular streaks; apex whitish. The whorls are rather weakly convex, less so than in *A. purpurea* or *A. ventricosa*. Suture with a rather weakly defined margination. Surface closely granulose, the granules in spiral lines and superposed on the irregular axial wrinkles, a little weaker below the periphery; on the early whorls similar to those of *A. purpurea*. The aperture is ovate, pale vinaceous-pink within, somewhat darker within the lip edge. Columella and parietal callus vinaceous, with a darker outer edge. Measurements are as follows: Type: length, 105 mm. [an obvious misprint, the actual length of the type being 115 mm.]; diameter, 68.5 mm.; length of aperture, 72.2 mm.; number of whorls, 7. Paratype: length, 99 mm.; diameter, 61.7 mm.; length of aperture, 66.2 mm.; number of whorls, $6\frac{1}{3}$. The shape is about that of *A. rhodostoma* (Philippi), but it differs from that by the well-developed granulation of the last whorl, as in *A. purpurea* and *A. ventri-*

cosa, and by the longer aperture, over 68 per cent of the length of the shell, while in *rhodostoma* the aperture occupies about 57 per cent and in *A. rhodostoma splendida* about 69.6 per cent. In *A. spectaculum* the aperture is distinctly narrower than in *A. rhodostoma*, *purpurea*, or *ventricosa*. The parietal callus has a dusky edge, not a lighter edge as in *A. rhodostoma*, in this respect resembling *A. purpurea*. The interior in *A. spectaculum* is decidedly paler than in *A. purpurea* and *A. ventricosa*, and the whorls are much less convex than in those species." The proper placing of *A. spectaculum* among the purple-mouthed *Archachatina* has given considerable trouble. It was thought at first that it might be identical with what was later described as *A. degneri*. A careful study of holotype and paratype at U.S.N.M. has shown that this was not possible, since *A. degneri* shows only faint traces of decussation on the last whorls, particularly on the body-whorl, while these whorls are distinctly granulose in *spectaculum*. It was eventually recognized that *spectaculum* is very closely related to *A. ventricosa*. Some of the shells which I had previously called *ventricosa* were not separable from Pilsbry's types. As *A. ventricosa* is rather variable in size, shape and sculpture, *spectaculum* may well represent individual extreme variants of this species. Too few specimens with reliable localities are known, however, to reach a final conclusion at present; so that I provisionally retain *spectaculum* with subspecific status. It seems to differ from the nominate race of *ventricosa* only in being relatively more slender, with less convex body-whorl, more raised spire and the aperture higher in proportion to the width. It also has nearly one whorl more for the same size. It should be noted that neither of the types has the expanded outer lip of completely grown specimens; the paratype is more immature than the holotype, and also has the granulose sculpture less pronounced. The holotype is shown in Pl. 18, fig. 1, after a new photograph kindly made for this paper by the U.S.N.M. Measurements of more fully adult shells are given below and some of them are figured.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
125.5 mm.	72	75.5	40	7 $\frac{1}{3}$		"West Africa"
115.5	67.5	67	37	7		Cape Palmas
110.5	66.5	60	35	7		Liberia
107	62.5	60.5	32	6 $\frac{3}{4}$		"
103.5	59.5	57.5	33	6 $\frac{3}{4}$		"
101	59	55.5	32	7		"

Specimens Examined. "West Africa," holotype (U.S.N.M. No. 406386) and several other shells (U.S.N.M.; M.C.Z.). "Gambia," paratype (U.S.N.M. No. 20222 [not 20220]), an extremely doubtful locality, as no other specimen of *Archachatina* has been reliably recorded from that section of West Africa. — LIBERIA: several without more precise locality (M.C.Z.); Cape Palmas (Ferrand.—M.C.Z.).

ARCHACHATINA (CALACHATINA) DEGNERI Bequaert and Clench

Pl. 18, fig. 3; Pl. 56, fig. 3; Pl. 69, fig. 2

Achatina purpurea Allen and Thompson, 1848, Narrative Expedition Niger in 1841, **2**, p. 510 (Southern Nigeria: Nun River). Reeve, 1848, Conch. Icon., **5**, *Achatina*, Pl. 4, fig. 15a (only). Shuttleworth, 1852, Mitth. Naturf. Ges. Bern, Nos. 248–249, p. 201 (specimens supposedly from Gaboon). v. Martens, 1886, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 114 (Gold Coast: Abetifi). Not of Gmelin, 1790.

Achatina rhodostoma v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 203 (shell in Berlin Mus., 115 mm. long, 69 mm. wide, the aperture 69 by 44 mm.); 1893, Mitth. Deutsch. Schutzgeb., **6**, pt. 3, p. 216 (Togo: Bismarekburg). Not of Philippi, 1849.

Achatina (Archachatina) rhodostoma Germain, 1912, Ann. Inst. Océanogr. Monaco, **5**, pt. 3, p. 124 (Dahomey: Abomey). Not of Philippi, 1849.

Archachatina rhodostoma splendida C. R. Boettger, 1927, Abh. Senckenb. Naturf. Ges., **39**, pt. 4, p. 355 (shell, later made the type of *degneri*, "supposedly from Duma, Belgian Congo," obviously a locality error). Not of Pilsbry, 1905.

Achatina (Archachatina) rhodostoma var. *splendida* Germain, 1912, Ann. Inst. Océanogr. Monaco, **5**, pt. 3, p. 125, fig. 4 (Dahomey: Abomey). Not of Pilsbry, 1905.

Achatina ventricosa Spence, 1928, Jl. of Conch., **18**, pt. 7, p. 213 (Gold Coast: Bunso Plantation, 10° 28' W., 6° 18' N.). Not of Gould, 1850.

Archachatina (Magachatina) degneri Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 78 (shell supposedly from Duma, Belgian Congo, called *A. rhodostoma splendida* by C. R. Boettger in 1927); Pl. 1, fig. 1 (type).

I have not seen the shells called *purpurea* by Allen and Thompson (1848) and v. Martens (1866), *rhodostoma* by v. Martens (1860; 1893) and Germain (1912), and *ventricosa* by Spence (1928), listed in the foregoing synonymy. I have referred them to *degneri* on zoogeographical grounds, as these several species are not known at present with certainty to occur in the parts of West Africa from which these authors mentioned them.

As *A. degneri* is a common, large and conspicuously colored snail in the Gold Coast, where it is a usual article of the native diet, it was

no doubt known to some of the earlier malacologists and collectors. It seems to have been confused first with *A. purpurea* and later with other large *Archachatinae*, particularly *A. rhodostoma* and its var. *splendida*. Reeve's (1848) Pl. 4, fig. 15a unquestionably represents it, his specimen being about average size, 120 mm. long, 73 mm. in greatest width, the aperture 72 by 40 mm., and easily matched with some of the shells I obtained at Accra. Shuttleworth's (1852) supposed *purpurea*, with which he compared his *porphyrostoma*, was described as follows: "*A. purpurea*, ab auctoribus incomplete descripta et delineata, dimensionibus valde alienis gaudet. Specimina mea, ex Gabon missa, 117 mm. longa et 66 lata sunt. Apertura etiam 71 mill. longa et 48 lata: anfr. ultimus valde inflatus, peristoma etiam ut in *A. marginata* expanso-patulum. Specimina juvenilia (anfr. 5) 60 mill. longa et 48 lata: Apert. 37 mill. longa et 25 lata." These shells could only have been *degueri*, even though the species is not known to occur in Gaboon, so that the locality should be regarded as erroneous. *A. marginata*, which exists in Gaboon, is ruled out, first because Shuttleworth uses it for comparison; secondly because he mentions no difference in color from his *porphyrostoma*, so that his shells must have been extensively purplish inside the aperture, a character not found in any of the several forms of *marginata* with which I am acquainted. The dimensions given do not fit *A. rhodostoma*.

A. degueri was originally described as follows, from a single adult specimen: "Shell solid, subovate, imperforate and somewhat shiny. Color: first three and a half whorls uniformly light brownish-yellow; following two whorls barred with irregular reddish-brown axial streaks which overlie the light brownish-yellow ground color; the reddish-brown color bars continue to the aperture, but the ground color changes from brownish-yellow to a decided light greenish-brown. On the last two whorls there appear upon close inspection a series of faint grayish, very fine zigzag lines, arranged more or less axially. Entire interior area of aperture, columella and parietal callus a deep vinaceous-red (Ridgway's pomegranate purple); extreme inner edge of outer lip and outer margin of parietal callus grayish-purple. Whorls 7, convex, the last two impressed somewhat below the suture. Spire somewhat extended, produced at an angle of 60°. Body whorl about 77 per cent of the total shell. Aperture rounded-ovate, about 65 per cent of the length of the shell, widest below the middle. Palatal lip flaring, bell-like, slightly thickened. Columella rather wide and twisted within, nearly straight and rather abruptly and broadly truncate. Sculpture: first one and a half whorls minutely rugose, gradually merging into the distinct, but very fine, beaded, decussate sculpture of the next three and a half whorls; on the remaining whorls the

sculpture becomes irregular and the beading is only very faintly indicated; body whorl roughened somewhat by the coarse growth-lines."

The type of *A. degneri* (Pl. 69, fig. 2) was an unusually large specimen, moreover from an erroneous locality. The species was since collected alive in some numbers in the Gold Coast, so that it is possible to give some additional information which may help to recognize it. When fully adult, with well formed and expanded outer lip, the shell is similar in outline and shape of aperture and columella to the nominate race of *A. marginata* and even more so to *A. ventricosa*. The subsutural impressed line of *marginata* is often lacking in *degneri* and, if present (as in the holotype), it is rather weak and irregular. The periostracum of *degneri* lacks the regular criss-cross, cancellate ("weave-like") microsculpture of *marginata*; instead, when well preserved, it is microscopically and irregularly rugulose. The granulose decussation is more pronounced in *degneri* than in *marginata*, although of the same general type; but it is very much weaker than in *ventricosa* and *purpurea*, being barely visible to the naked eye on the body-whorl. In this respect *degneri* approaches *A. rhodostoma*, although the sculpture is even weaker in the latter. On the other hand the growth-striae of the body-whorl are usually coarser in *degneri* than in either *marginata* or *rhodostoma*. When full-grown, *rhodostoma* differs also from *degneri* in being more slender in outline, with much less ventricose body-whorl and a relatively narrower aperture. The immature stages of these two species can, however, be readily confused. I regard Germain's fig. 4 (1912) of a supposed *A. rhodostoma* var. *splendida* as a young *A. degneri*.

In the holotype, the columella, parietal wall, inner margin of outer lip (except for the narrow edge) and entire inside of the aperture to far back in the shell are a gorgeous deep vinaceous-red. This is true also of a few of the shells I collected in the Gold Coast. More often, however, the inside is reddish, in varying shades from orange-red to violaceous, only near the outer lip over a width of an inch or less. All transitions may be observed between these two extremes. Possibly the vinaceous color spreads inward from the outer lip with age and becomes also more intense as the adult snails grow older.

The smallest immature *degneri* seen, from Nsawam (Pl. 18, fig. 3), is 28.5 mm. long, 21 mm. wide, of about 4 whorls. The very first half nepionic whorl is finely wrinkled; the remainder are densely granulose, in fairly regular spiral rows, but much more weakly below the periphery of the fourth whorl. The columella has a broad and deep umbilical slit, but is strongly truncate at the base. At the next larger stage seen, 62 mm. long, of $5\frac{1}{3}$ whorls, the columella shows no trace of a slit. In most adult shells the nepionic sculpture is fairly well preserved.

Specimens Examined. Holotype (Hamb.M.), labelled "Duma, Belgian Congo," certainly an erroneous locality, the shell having probably been obtained either in Togo or the Gold Coast. The collector, H. Schubotz, was a member of the Second German Central African Expedition of the Duke of Mecklenburg (1910-1911). This started from the West Coast of Africa, eventually travelling overland across Cameroon and French Equatorial Africa to the Ubangi River. Most probably the malacological collections were either incompletely labelled or had lost their labels before reaching Europe, and having been shipped from Duma were assumed to have been collected there. — GOLD COAST: Accra, many specimens, offered for sale in the native market; Bawaleshi near Accra; Suhum near Accra; Senchi on the Volta River; Nsawam (M.C.Z.—All collected by J. Bequaert, A. R. Mead, and V. Dethier. Several snails of these lots were dissected by Dr. Mead); St. George d'Elmira (Amst.M.). — DAHOMEY: Abomey (Brus.M.).

The holotype is the property of the Hamburg Museum and has now been returned there, having been in the custody of the M.C.Z. since 1935. It is unusually large, but some of the shells I obtained in Accra are only slightly smaller.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
145 mm.	91	94	54	7		Holotype
137	82	83.5	47	6½		Accra
127.5	80.5	78.5	44	6½		Bawaleshi
120	72.5	75	42	6½		Accra
116.5	74	70	41	6½		Nsawam
114.5	71.5	68	41	6½		Suhum
107.5	65	64	37.5	6¼		Nsawam
101	63.5	64	36	6¼		"

In the Gold Coast *A. degneri* is a much appreciated article of the native diet, being considered superior in taste by the epicurians to *Achatina achatina*, which is also eaten there. It is nearly always found in the native markets and its gathering is strictly regulated by native tribal custom. The snail is mentioned by Dr. David Fairchild in his book "Exploring for Plants" (1930, p. 536), one of his photographs showing live snails offered for sale at Nsawam. In the London "Times Weekly Edition" of September 1, 1936, there appeared the following letter by one "W.G.G.C." relating to the "Snail Trade on the Gold Coast": "Many years ago I trekked into a village near the Western

Frontier and found it deserted, but for a very old couple. I learnt that the townspeople were prisoners of a former powerful Sefwi chief, upon whose land they had been caught poaching snails. Incidentally, this is the finest snailing country in the Colony, and a very large trade exists between it and Kumasi, the capital of Ashanti. The fee for a license to snail here was at one time £5, and a man could take away all that he could carry in one load, probably about £10 in value. It is usual to eat only the yearlings, the three-year-olds being the chief breeders." A more recent note on the subject in "The Field" (April 6, 1940, **175**, No. 4554, p. 546), by C. S. Cansdale, is entitled "Giant Forest Snails of the Gold Coast": "The giant forest snail forms one of the most important meat supplies of the Gold Coast forest country and the trade in dried snails reaches an annual value of thousands of pounds. The collection is carefully controlled by local rules concerning collecting areas, close seasons, etc., and these are rigidly enforced. Family parties set off into the dense forest and bring back loads of snails to their hunting camps or villages; the shells are broken and the snails impaled on long wooden skewers and smoked over wood fires. It is in this form that they are sold for soup making. The size of these two snails can be judged by the half a crown placed on the shell of one of them." Mr. Cansdale's accompanying photograph shows alive both species that are eaten in the Gold Coast: the left-hand snail is *Achatina achatina*, the right-hand one *Archachatina degneri*.

In Ashanti, where *Achatinae* seem to be particularly sought after, the Government issued in 1944 an Order regulating their collection. It empowered the Chief to prohibit or restrict the gathering of snails on land within his jurisdiction. Infringement of the Chief's orders was made liable to a fine of £5 or imprisonment for 2 months.¹

ARCHACHATINA (CALACHATINA) RHODOSTOMA (Philippi)

Pl. 13, fig. 2; Pl. 22, fig. 2; Pl. 28, fig. 1;

Pl. 33, fig. 1; Pl. 73, fig. 3; Pl. 74, fig. 1

Achatina purpurca G. B. Sowerby, 1823 (March), Gen. Rec. Fossil Shells, pt. 14, *Achatina*, Pl., fig. 1 (with name on plate and in letterpress; no locality; shell 129 mm. long, 72 mm. in greatest width, the aperture 72 by 40 mm.). Reeve, 1842, Conch. System., **2**, p. 85; Pl. 176, fig. 1 (copy of Sowerby's fig.). Not of Gmelin, 1790.

Achatina rhodostoma Philippi, 1849 (April), Abb. Beschr. Conch., **3**, pt. 5, p. 29 (p. 7 of *Achatina*) (no locality); Pl. 2 (of *Achatina*), fig. 2. Pfeiffer,

¹ I am under obligation to the Colonial Secretary's Office at Accra and to Mr. M. A. Tazelaar, of University College, Achimota, Gold Coast, for a copy of this Government Regulation.

- 1849, Zeitschr. f. Malakoz., **6**, p. 92; 1853, Monogr. Helic. Viv., **3**, p. 484. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer, 1857, Syst. Conch.-Cab., **1**, Abt. 13, pt. 1, p. 293; Pl. 23, fig. 3 (copy of Philippi's fig.). v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 201 (in part only). A. D. Brown, 1861, Cat. Shells Coll., p. 56 (Liberia: Cape Palmas). Bielz, 1865, Verzeichn. Moll. Conch.-Samml., 3d Ed., p. 23. Haines, 1868, Cat. Terr. Shells Coll., p. 68 (Liberia: Cape Palmas). Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 213. Paetel, 1869, Moll. Syst. Cat., p. 80; 1873, Cat. Conch.-Samml., p. 99. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 53. Pfeiffer, 1877, Monogr. Helic. Viv., **8**, p. 273. Grasset, 1884, Index Test. Viv. Coll., p. 199. Rethaan Macaré, 1888, Cat. Coll. Coq. Mne. Rethaan Macaré, p. 23. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240. Bourguignat, 1889, Moll. Afr. Equat., p. 77. *Achatina* (*Archachatina*) *rhodostoma* Albers, 1850, Die Heliceen, p. 190. *Achatina* (*Achatinus*) *rhodostoma* Pfeiffer, 1856, Malak. Blätt., **5**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 123. *Archachatina rhodostoma* Pilsbry, 1905, Man. of Conch., (2), **17**, p. 115; Pl. 22, fig. 11 (after Philippi). Kobelt, 1910, Abh. Senckenb. Naturf. Ges., **32**, p. 67. *Archachatina* (*Magachatina*) *rhodostoma* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 84 (French Guinea: Kankan). *Archachatina rhodostoma* var. *splendida* Pilsbry, 1905, Man. of Conch., (2), **17**, p. 116 ("West Africa"); Pl. 22, fig. 12 (holotype; refers to it also Reeve's Pl. 176, fig. 1 of 1842). Kobelt, 1910, Abh. Senckenb. Naturf. Ges., **32**, p. 67. *Archachatina* (*Magachatina*) *rhodostoma* var. *splendida* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 85; Pl. 2, fig. 12 (holotype.)

Original description of *A. rhodostoma* Philippi (1849): "A. testa oblongo-conica, crassiuscula, striata, sub epidermide fulvo-lutea albida, strigis crebris, rectis, rufis, longitudinalibus ornata; spira conica obtusiuscula; sutura parum crenulata, vix marginata; anfractibus $6\frac{1}{2}$, parum convexis, summis tenuissime decussato-granulatis, inferioribus laevissimis, ultimo spiram superante; columella valde arcuata, purpurea, basi oblique truncata; apertura ampla semiovali, in fundo lilacina, anterieus purpurea; peristomate acuto, marginibus callo nitido purpurascente introrsum diffuso junctis. Alt. $40''$ [= 87 mm.]; diam. $23''$ [= 50 mm.]" The following additional remarks are translated from the German: "I had this species for a long time as *A. purpurea*, until I received a beautiful specimen of the latter from M. Petit de la Saussaye, and found it to differ greatly from the present shell. Apart from the size, which reaches $4\frac{1}{2}$ inches [= 117.5 mm.] in *purpurea*, that species is much wider, more conical, more pointed, the sutures are strikingly marginate, which is scarcely indicated in *A. rhodostoma*;

finally the surface is distinctly and strongly granulose in *A. purpurea*, even on the body-whorl, not at all *obsolete decussata*. The color likewise differs somewhat. Lamarck describes *A. purpurea* as brownish-red, with spaced, oblique, zigzag rust-brown streaks, and the body-whorl beneath the yellow periostracum pale bluish-violet or grey, with occasional dark vertical streaks. Our *A. rhodostoma*, on the other hand, is ornamented with straight reddish-brown vertical streaks on a pale brownish-white background, the streaks very crowded on the body-whorl, where they cover much more of the surface than the ground-color." The present location of the type is unknown. The foregoing account, together with the original figure, copied in my Pl. 13, fig. 2, makes recognition not too difficult, although it is one of the rarer species in collections. Philippi compared it evidently, not with the true *A. purpurea* (Gmelin) as recognized in the present paper, but with *A. ventricosa* (Gould), which actually differs from *rhodostoma* in the characters he pointed out.

Pilsbry's var. *splendida* is in my opinion a fully adult specimen of *rhodostoma* with the outer lip thickened and expanded, Philippi's type being as yet immature. It was described as follows: "Acute ovate, thick and heavy. Whorls $6\frac{1}{2}$, the last two with a distinct sutural margin. Surface minutely, somewhat obsoletely granulose even on the last whorl; irregularly streaked with brown on a lighter ground, under a thin yellow cuticle, the spire marbled with white and angularly streaked with brown. Aperture bright pink inside, with a band of deeper salmon-pink near the edge, which is bordered with white. Columella similarly colored. The outer and basal margins of the lip are expanded. Length 117, diam. 70, length of aperture 70 mm." I have studied in Philadelphia the unique type, shown in my Pl. 28, fig. 1, from a photograph. The aperture is 38 mm. wide. The granulation of the body-whorl is much weaker than in *A. ventricosa* and *A. purpurea*. As recognized by Pilsbry, the same form was figured, as *A. purpurea*, by Sowerby (1823) and Reeve (1842), both figures being based on the same shell. Sowerby's original is copied in my Pl. 74, fig. 1. It shows the largest known example of the species, being 128.5 mm. long, 72 mm. wide, with the aperture 72 by 41 mm.

The true *A. rhodostoma* is rare in collections. Shells so called are more often *A. purpurea* or immature *A. ventricosa*. Although included in my bibliography, the shells recorded by A. D. Brown (1861), Bielz (1865), Haines (1868), Paetel (1869, 1873, 1889), Roeters van Lennep (1876), Grasset (1884), Rethaan Macaré (1888) and Römer (1891) may not all be correctly named. The reported locality Cape Palmas I cannot at present regard as reliable. There are thus far only three precise localities for the species. Popolahun, in northwestern Liberia

(8° 15' N., 10° 15' W.), Kankan, in French Guinea (10° 20' N., 9° W.), and Bouaké, in the Ivory Coast (about 7° 38' N., 5° W.). I was fortunate to collect at Popolahun a fair number of specimens in various stages of growth, which enabled me to recognize the true specific characters and also to connect the immature "*rhodostoma*" with the fully adult "*splendida*" stage.

A. rhodostoma, when fully adult, is most easily recognized among the purple-mouthed *Archachatinae* by the extremely weak decussate or granulose sculpture, which it shares only with *A. degneri*. On the body-whorl and over most of the penultimate whorl the granulations are small or even superficial, sometimes nearly lacking, being barely seen with the naked eye and not felt by touch. The granulation is perhaps even less pronounced in *A. degneri*, which however, has coarse growth-striae, while in *rhodostoma* the surface of the body-whorl is nearly even. In general shape *rhodostoma* is often relatively more slender, with a somewhat higher spire, than *degneri* and *ventricosa*. Some of the more slender *ventricosa* may approach it in shape, in which case the two must be separated solely on the basis of sculpture. At Popolahun I collected both species, but was unable to find truly transitional specimens. On the other hand, while immature and particularly very young *rhodostoma* are decidedly more slender than *ventricosa* or *degneri* of the same age, they are very similar in shape to some adult *A. purpurca*, a species which does not develop an expanded outer lip when full-grown. Young *rhodostoma* are more finely granulose than *purpurca* and the whorls are not so convex. *A. rhodostoma* may sometimes simulate small *A. marginata*, particularly if the inside is not fully colored or is faded; but the periostracum lacks the criss-cross microsculpture of that species, being instead minutely and irregularly rugulose.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width	Width		
120.5 mm.	72	71	37	6½	Popolahun	
115	69	69	36	6½	"	
102	62	56	33	6½	"West Africa"	
101	62	63	35	6½	Popolahun	
98	63	62.5	33.5	6	"	
96.5	57	54	30.5	6½	"	
91	53	52.5	28	6	"West Africa"	
88	51.5	50.5	27.5	6	Popolahun	

Specimens Examined. "West Africa," holotype of *A. rhodostoma* var. *splendida* (Ac.N.S.Phila., No. 3095), and some immature shells (Hamb.M.; Ac.N.S.Phila.; Leid.M.; Amst.M.; Berl.M.; Brit.M.; U.S.N.M.; M.C.Z.). — LIBERIA: without more precise locality (Brus.M.); Popolahun (J. Bequaert.-M.C.Z.). — FRENCH GUINEA: Kankan (Brus.M.; M.C.Z.). — IVORY COAST: Bouaké (R. Delattre.-M.C.Z.).

3. Subgenus MEGACHATINOPSIS Bequaert and Clench

Archachatina subg. *Megachatinopsis* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 76. Type by original designation: *Achatina knorrii* Jonas, 1839.

Archachatina subg. *Megachatinops* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 87 (misspelling of *Megachatinopsis*, with same type).

Full-grown shell medium-sized (50 to 120 mm. long), broadly ovate, elongate ovate, or spindle-shaped, of 5 to 7 whorls, normally dextral, often thin and light. Surface even; nepionic whorls of newly hatched snails finely granulose; later whorls either granulose, coarsely decussate or almost smooth. Outer lip always simple, the edge usually thin and sharp, not at all expanded.

1. *A. camruncensis* d'Ailly, 1896. See Pl. 53, fig. 4 (summit).
2. *A. knorrii* (Jonas, 1839). See below.
3. *A. papyracea* (Pfeiffer, 1845). See below.
4. *A. purpurea* (Gmelin, 1790). See below.
5. *A. siderata* (Reeve, 1849). See below.

ARCHACHATINA (MEGACHATINOPSIS) KNORRII (Jonas)

Pl. 37, figs. 1-2; Pl. 39, fig. 2; Pl. 40, fig. 1; Pl. 51, fig. 3; Pl. 53, fig. 1; Pl. 56, fig. 1; Pl. 76, fig. 1

[The Heirs of G. W. Knorr, 1768, Vergnügen der Augen und des Gemüths, **3**, p. 11; first printing of the Plates of the 1st Edition, Pl. 3**, fig. 1 (Plate marked "ex Musco Breyniano"); 1768, Délices des Yeux et de l'Esprit, **3**, p. 11; first printing of Pl. 3**, fig. 1 (as above)].

Achatina knorrii Jonas, 1839, Arch. f. Naturgesch., **5**, pt. 1, p. 345 (description of 2 shells; no locality; with reference to Knorr's Pl. 3**, fig. 1). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 165. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 250; 1853, *Op. cit.*, **3**, p. 485 (West Africa. New description of shell in Hamburg Mus.). H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 601. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 201. Pfeiffer, 1865,

- Syst. Conch.-Cab., 1, Abt. 13, pt. 1, p. 365; Pl. 47, figs. 11-12 (specimen). Haines, 1868, Cat. Terr. Shells Coll., p. 67. Pfeiffer, 1868, Monogr. Helic. Viv., 6, p. 214; 1876, *Op. cit.*, 8, p. 274; 1877, *Op. cit.*, 8, p. 616. Dohrn, 1878, Jahrb. D. Mal. Ges., 5, p. 156 (Liberia). Grasset, 1884, Index Test. Viv. Coll., p. 199. Schepman, 1888, Notes Leyden Mus., 10, p. 247 (Liberia). Paetel, 1889, Cat. Conch.-Samml., 4th Ed., 2, p. 240. Büttikofer, 1890, Reisebilder aus Liberia, 2, pp. 454 and 481. Johnston, 1906, Liberia, 2, p. 861.
- Achatina (Archachatina) knorri* Albers, 1850, Die Helicen, p. 190.
- Achatina (Achatinus) knorri* Pfeiffer, 1856, Malak. Blätt., 2, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265.
- Achatina (Urceus) knorrii* Mörch, 1857, Cat. Conch. Suenson, p. 6.
- Serpaea knori* Bourguignat, 1889, Moll. Afr. Equat., p. 85.
- Archachatina knorrii* Pilsbry, 1905, Man. of Conch., (2), 17, p. 118; Pl. 20, figs. 1-3 (2 specimens). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 66.
- Archachatina (Megachatinopsis) knorri* J. Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., 29, pt. 1, pp. 76 (as type of subg. *Megachatinopsis*) and 91 (Liberia: Camp No. 3 on Du or Dukwa River [now Harbel Plantation]; Kakatown [Kakata]; Gbanga; Paiata; Vahun; Robertsport).
- Achatina prunum* Reeve, 1849, Conch. Icon., 5, *Achatina*, Pl. 4, fig. 13 (West Africa). H. and A. Adams, 1855, Gen. Rec. Moll., 2, p. 132. (Anonymous), 1875, 27th Ann. Rept. New York State Mus., (for 1873), p. 51 (specimen in Gould Coll.). Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 54.

In Knorr's work, vol. 3 of which was published after Knorr's death by his Heirs, the following text (translated here from the German) describes Pl. 3**, fig. 1, of the first German and French printings of part 3: "This thin buccinum with broad waves is the most ventricose of all. The first whorl [= body-whorl] is beautifully convex; its ground color is white, drenched with red like that of apple-flowers, over which descend broad chestnut-brown waves. The upper whorls [= spire] are beautifully red. The shell is thin, transparent and whitish inside, but in such a way that the brown waves show through somewhat. Some specimens are half a foot long; but there is also a small kind which measures only one or two inches." In the French copies, the text is a fairly exact translation from the German.¹ The figure, copied in my Pl. 39, fig. 2, is clearly based on the species later described by Jonas as *Achatina knorrii*. It shows, from the back, a shell deprived of the periostracum and probably polished, 83 mm. long and 47 mm. in greatest width, being one of the largest known of the species.

Jonas' original description of *A. knorrii* was as follows: "*A. testa*

¹ Some copies of part 3 of Knorr's work, both with the French and the German text, have plates of a second printing. In these, Pl. 3**, fig. 1, represents *Archachatina marginata* (Swainson), not *A. knorrii*. The matter is discussed at some length under *A. marginata*.

ovata, ventricosa, decussata, superne intense rosea, inferne ex roseo albescente, flammis longitudinalibus fuscis inferne latioribus, ad basin confluentibus, ibique nigrescentibus eleganter picta; anfractibus senis convexis, duobus infimis infra suturam linea impressa circumdatis, ultimo spira longiore; spira conica, obtusa; apertura oblongo-ovata, intus alba, labro limbo fusco marginato; columella arcuata, callosa, nitida, alba. Longit. 2' ' 11' ' ' [German inches and lines=76 mm.]. Latit. 1' ' 8' ' ' [=43.5 mm.]. Aperturæ altitudo 1' ' 10' ' ' [=48 mm.]. Epidermis viridi-flava est." This description was based on two shells, whose present whereabouts is not known. Jonas' reference to Knorr's figure is to the first printing of the Plates of vol. 3. The shell described anew by Pfeiffer in 1853, from the Hamburg Museum, may have been one of Jonas' types, as the measurements agree fairly well. Pfeiffer's (1865) figures appear to be of another shell, however. Pilsbry's (1905) figures are excellent.

Original description of *A. prunum* Reeve (1849): "Achat. testa ovata, tenui, ventricosiuscula, spira apicem versus obtusa, anfractibus quinque, infra suturas appressis, laeviusculis, apicem versus minutissime decussatis, columella arcuata, vix truncata; aureo-lutescente, castaneo latistrigata, superne purpureo-rosea. Shell ovate, thin, rather ventricose, obtuse towards the apex, whorls five in number, appressed beneath the sutures, somewhat smooth, very minutely decussated towards the apex, columella arched, but slightly truncated; pale golden-yellow, broadly streaked with chesnut, purple-rose towards the upper part. A striking species, distinguished by its obtuse growth and peculiar colouring. The last whorl is of a delicate golden-yellow, marked with dark chesnut streaks converging together at the base, whilst the upper whorls are of a purple-rose, indistinctly spotted at the sutures. The species may possibly have been taken for the young of *A. marginata*, but is certainly distinct." Although *prunum* was described from the Cuming Collection, I was unable to find the type at the British Museum in 1933. Possibly Cuming recognized later that it was *A. knorrii* and deleted Reeve's name from his collection. Fortunately there can be little doubt that it is a synonym of *knorrii*. Reeve's figure, copied in my Pl. 40, fig. 1, is 68 mm. long, 39 mm. wide, with the aperture 38 by 21 mm. Some of the *knorrii* I collected in Liberia agree well with it.

Adult *A. knorrii* is a medium-sized shell, rarely exceeding 80 mm. in length, broadly fusiform or spindle-shaped, light, thin but fairly solid, translucent, the darker pattern showing inside the aperture; elliptical in outline, widest at about mid-length. Spire short, scarcely narrower than the base, forming a very wide cone, ending in a broadly rounded, dome-shaped apex. Whorls $5\frac{1}{4}$ to $5\frac{1}{2}$, moderately and

increasingly convex from the third on, with narrow, shallow sutures. Flattened subsutural area as a rule restricted to the body-whorl, narrow, set off by a weakly impressed line. Upper 3 whorls (including nepionic shell) forming a broad, hemispherical dome; first whorl much flattened; succeeding whorls gradually increasing in length and width. Body-whorl very long, about four-fifths of the total length of the shell in front view, fairly obese, slightly more convex than penultimate whorl. Aperture broadly semi-elliptical, longer than half, though shorter than two-thirds of the total length of the shell; outer margin evenly and moderately curved. Inside bluish-white, the inner edge with a broad, dark purplish-brown margin. Outer lip thin, sharp, not at all expanded nor flaring, scarcely or not produced forward in profile, not appreciably descending at the insertion on the body-whorl. Parietal wall with a very thin, bluish-white glaze. Columella very narrow, nearly straight or slightly concave, gradually narrowed below to the oblique truncation, which is placed close to the base of the outer lip; entirely bluish-white in all examples seen. Youngest shell seen (31 mm. long; 4 whorls) with the early 3 whorls densely and minutely granulose in spiral rows, except the first which has fine vertical wrinkles (Pl. 76, fig. 1). Granulose sculpture rapidly decreasing in strength from the fourth whorl on, faintly indicated or nearly wanting on the body-whorl, which to the naked eye appears smooth with many low growth-wrinkles; under the lens it shows a few, weak, more or less interrupted engraved lines, below as well as above the periphery and is in addition microscopically rugulose, but not "cancellate." Periostracum thin, readily lost, very pale straw-yellow, shiny; shell underneath it white, except on the spire which is dull purplish-red (sometimes faded to pink) as far as most of the penultimate whorl. Early whorls with only faint traces of vertical darker streaks, which become more pronounced on the penultimate whorl. Body-whorl, as a rule, boldly marked with broad, straight, wavy or zigzag, dark chestnut-brown streaks, fairly regularly spaced; streaks often extending separately from suture to base, sometimes confluent near the columella; or they may be narrow, interrupted, divided into fine, wavy lines, or broken up into blotches above the periphery, or some of them may stop abruptly at the periphery; in a few shells most of the lower half of the body-whorl chestnut-brown, irregularly jagged toward the periphery. In addition, the subsutural depressed area is ornamented with alternate yellowish and dark-brown blotches, some of the latter connected with vertical streaks, producing a peculiar tessellated design, more pronounced in some shells than in others. The tessellation occurs also on the spire, where it may be traced to the third whorl in young shells. The egg is as yet unknown.

Specimens Examined. LIBERIA: several without more precise locality (Ac.N.S.Phila.; U.S.N.M.; M.C.Z.; Amst.M.; Leid.M.; Berl.M.); Harbel (Firestone Plantation), on the Du or Dukwa River (J. Bequaert.-M.C.Z.); Kakata (J. Bequaert.-M.C.Z.); Paiata (or Pehata) (J. Bequaert.-M.C.Z.); Degei (J. Bequaert.-M.C.Z.); Gbanga (J. Bequaert.-M.C.Z.); Paynesville near Monrovia (J. Bequaert.-M.C.Z.); Lakrata (J. Bequaert.-M.C.Z.); Jenne (J. Bequaert.-M.C.Z.); Vahun (E. Maass.-Hamb.M.); Ganta (G. W. Harley.-M.C.Z.); Robertsport (J. Büttikofer.-Leid. M.).—Several collections also have specimens labelled merely "West Africa." I have seen some erroneously labelled "Niger" (Brus.M.) and "Prince's Island" (U.S.N.M.).

A. knorrii is known with certainty from Liberia only, where it is restricted to primary rain forest and appears to be fairly widely distributed, although there are as yet no records from the southeastern half of the country. It appears to be absent from the Cape Palmas region. It disappears where the primary rain forest is replaced by thickets of second-growth woody vegetation. As the virgin forest is now being rapidly destroyed, the species may well become extinct within the next half century. The snail is strictly terrestrial and lives so well hidden in the undergrowth and litter that it is rarely seen alive.

d'Ailly's (1896) records of *A. knorrii* from Cameroon were based on misidentifications of *A. papyracea* (Pfeiffer), which resembles it somewhat in shape and pattern. *A. knorrii* lacks, however, the more distinct granulation of the body-whorl of adult *papyracea*. I saw d'Ailly's specimens at the Stockholm Museum in 1933.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
81.5 mm.	48.5	49	25	5½	"	"West Africa"
76	41	43.5	21.5	5½	"	"
75	44	44	24	5½	"	Liberia
72.5	41	45.5	23	5½	"	Harbel
67.5	38	40	21	5½	"	"
65	37.5	38.5	20.5	5¼	"	Jenne
62.5	34.5	37	19	5¼	"	Ganta
59	35.5	36	21	5¼	"	"

Pfeiffer's first (1853) specimen was 80 mm. long, 42 mm. wide, of 5 whorls, with the aperture 50 by 26 mm. He figured a much smaller shell in 1865, only 58 mm. long, 32 mm. wide, with the aperture 35 by 15 mm.

ARCHACHATINA (MEGACHATINOPSIS) SIDERATA (Reeve)

Pl. 41, fig. 3; Pl. 52, fig. 3; Pl. 61, fig. 2; Pl. 69, fig. 3

- Achatina sideratus* Reeve, 1849, Conch. Ieon., **5**, *Achatina*, Pl. 12, fig. 38 (locality unknown).
- Achatina siderata* Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 486. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 602. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 201 (Liberia). A. D. Brown, 1861, Cat. Shells Coll., p. 56 (Liberia: Cape Palmas). Haines, 1868, Cat. Terr. Shells Coll., p. 68. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 216; 1876, *Op. cit.*, **8**, p. 274. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 51. Grasset, 1884, Index Test. Viv. Coll., p. 199. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240. Aneey, 1902, Jl. de Conchyl., **50**, p. 280 (Liberia: Cape Palmas).
- Achatina (Achatinus) siderata* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265.
- Archachatina siderata* Pilsbry, 1905, Man. of Conch., (2), **17**, p. 117 (Liberia: Cape Palmas); Pl. 25, fig. 24 (after Reeve). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 67.
- Archachatina (Megachatinops) siderata* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 95 (Liberia: Cape Palmas; Bolahun).
- Achatina siderea* (Anonymous), 1875, 27th Ann. Rept. New York State Mus., (for 1873), p. 47 (specimen in Gould Collection).

Original description of *A. sideratus* Reeve (1849): "Achat. testa ovata, ventricosa, tenuicula. anfractibus quinque, creberrime minute granulatis, columella contorta; fusca, castaneo acute et subtiliter fulgurata, aperturæ fauce pallide caerulescente. Shell ovate, ventricose, rather thin, whorls five in number, very closely minutely granulated, columella twisted; brown, marked with fine sharply zigzag chestnut streaks, interior of the aperture faintly blue. This is apparently a shell of immature growth, but so peculiar in its colour and marking, that I venture to describe it as new. Of a warm brown silken hue, painted with fine sharply zigzag streaks somewhat broken, much more delicate and numerous towards the apex." The original figure, copied in my Pl. 41, fig. 3, is 55.5 mm. long, 32 mm. wide, with the aperture 33.5 by 17 mm. The type lot, seen at the British Museum in 1933, consists of 3 shells, including the one figured by Reeve, which may be selected as the lectotype. All three have a pale, whitish columella, which is true also of some 25 other examples I have seen of this species.

A. siderata is thinner and more fragile than *A. knorrii*, from which it is, moreover, separated by the slender, more regularly fusiform outline, the relatively broader and shorter spire, the shape of the

aperture and the sculpture. The aperture is half-pearshaped, being usually widest below the middle and somewhat flaring, while the edge extends forward in this area (in profile, Pl. 52, fig. 3); the terminal portion of the body-whorl is somewhat flattened or even slightly descending at the upper corner of the outer lip. All whorls are densely granulose, to near the outer lip; on the body-whorl the granulations are vertically elongate, rather than rounded, and extend over the base, though much weaker and more superficial below the periphery. The sculpture also differentiates *siderata* from *papyracea*, which in addition is not fusiform in outline, the spire being much narrower than the base.

Specimens Examined. "West Africa" (Hamb.M.; U.S.N.M.). — LIBERIA: without more precise locality (Brit.M.; Brus.M.; Berl.M.; A.M.N.H.; Ac.N.S.Phila.; M.C.Z.); Cape Palmas (Farrand.-M.C.Z.); Bolahun (E. Maass.-Hamb.M.; M.C.Z.). — The type lot at Brit.M. bears no locality.

A. siderata is restricted to Liberia, where it appears to be very rare and difficult to find. At any rate I was never able to obtain a specimen during my two West African journeys. Most shells in collections are small and immature.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
71 mm.	39	44.5	21.5	5½	Liberia	
65	33	39	19	5⅓	“	
60	33	37	19	5	“	
59	32.5	36.5	18.5	5	Cape Palmas	
57.5	32.5	34	18	5	Bolahun	
56.5	31.5	34.5	18	5	“	
55.5	31	35.5	18	5	Liberia	

ARCHACHATINA (MEGACHATINOPSIS) PAPYRACEA (Pfeiffer)

Pl. 5, fig. 1; Pl. 23, fig. 1; Pl. 60, fig. 1; Pl. 63, fig. 1;
Pl. 70, fig. 2; Pl. 72, fig. 4; Pl. 74, fig. 3; Pl. 81, fig. 1.

Achatina papyracea Pfeiffer, 1845, Proc. Zool. Soc. London, (for 1845), p. 74 (Southern Nigeria: Nun River); 1848, Monogr. Helic. Viv., **2**, p. 254. Reeve, 1849, Conch. Icon., **5**, *Achatina*, Pl. 2, fig. 6 (type from Cuming Collection). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 486. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 602; 1860, Syst. Conch.-Cab., **1**, Abt. 13, pt. 1, p. 329; Pl. 28,

- figs. 8-9. Morelet, 1867, Voy. Welwitsch, Moll. Terr. Fluv., (1868), p. 66 (Southern Nigeria: banks of the Niger). Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 215; 1876, *Op. cit.*, **8**, p. 274. Grasset, 1884, Index Test. Viv. Coll., p. 199. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 240.
- Achatina* (*Archachatina*) *papyracea* Albers, 1850, Die Heliceen, p. 190. Dautzenberg, 1921, Rev. Zool. Afric., **9**, pts. 1-2, p. 96.
- Achatina* (*Achatinus*) *papyracea* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265.
- Archachatina papyracea* Pilsbry, 1905, Man. of Conch., (2), **17**, p. 117; Pl. 44, fig. 1 (after Reeve); Pl. 23, figs. 17-18 (after Pfeiffer, 1860). Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66.
- Archachatina* (*Megachatinops*) *papyracea* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 92 (type and another specimen at British Museum).
- Achatina knorri* d'Ailly, 1896, Bih. Svenska Vet.-Akad. Handl., **22**, Afd. 4, No. 2, p. 63 (Cameroon: Etome; Bonge). Not of Jonas, 1839.
- Archachatina papyracea* var. *adelinae* Pilsbry, 1905 (March 1), Man. of Conch., (2), **17**, p. 118 ("West Africa"); Pl. 20, figs. 4 (paratype) and 5 (holotype); 1905 (December), The Nautilus, **19**, p. 96.
- Achatina* (*Archachatina*) *papyracea* var. *adelinae* Dautzenberg, 1921, Rev. Zool. Afric., **9**, p. 97 (Cameroon: Yaunde).
- Archachatina* (*Megachatinops*) *adelinae* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **19**, pt. 1, p. 87 (in part: Cameroon: Yaunde; Kribi; Bakundu Kaki near Elephant Lake. Gaboon. "West Africa"); 1938, The Nautilus, **52**, p. 27 (corrected localities).
- Achatina modestior* O. Boettger, 1905 (November 1), Nachrichtsbl. D. Malak. Ges., **37**, p. 167 (Cameroon: Rombone; Bolo Kurume; Nongo madiba; Bakunbundo; Johann-Albrechtshöhe near Kumba; Monbanda or Mbanda; Mukonje Farm); Pl. 7, figs. 1-2 only (2 views of holotype from Mukonje Farm).
- Achatina gracilior* Pilsbry, 1905 (December), The Nautilus, **19**, p. 96 (error for *modestior* O. Boettger). Not of C. B. Adams, 1850, nor of v. Martens, 1860.
- Achatina aurora* Pfeiffer, 1855, Proc. Zool. Soc. London, (for 1854), p. 294 (supposedly from Natal); 1859, Monogr. Helic. Viv., **4**, p. 602; 1868, *Op. cit.*, **6**, p. 215; 1877, *Op. cit.*, **8**, p. 274. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 239. Connolly, 1912, Ann. South African Mus., **11**, pt. 3, p. 191; 1916, *Op. cit.*, **13**, pt. 5, p. 188.
- Achatina* (*Achatinus*) *aurora* Pfeiffer, 1856, Malak. Blätt., **5** (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265.
- Cochlitoma aurora* Pilsbry, 1904, Man. of Conch., (2), **17**, p. 102. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., **32**, p. 66.
- Archachatina* (*Megachatinops*) *aurora* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 88 (type at Brit.M.).

Original description of *A. papyracea* Pfeiffer (1845): "Achat. testa ovato-oblonga, tenui, striis longitudinalibus et concentricis obsolete

decussata, diaphana, fulva, castaneo obsolete marmorata; spira conica, apice obtusa; sutura marginata; anfractibus $5\frac{1}{2}$ vix convexiusculis, ultimo spiram vix superante; columella subrecta, basin aperturæ fere attingente, oblique truncata, linea purpurea ornata; apertura ovali, intus margaritacea. Long. 66, diam. 30 mill." The species was originally described from the Cuming Collection and the type should therefore presumably be at the British Museum. In 1853 Pfeiffer repeated his earlier description without change, merely adding that the aperture was 35 mm. long and 19 mm. wide. He also noted that he had a specimen in his own collection, presumably a cotype which he had retained from the Cuming lot. In 1860 the description is the same, but the measurements are translated in German inches: length, $2\frac{3}{4}$ inches (=62 mm.); width, $2\frac{1}{4}$ inches (an obvious error for $1\frac{1}{4}$ inches=32.5 mm.). The figure accompanying the text in 1860 (Pl. 28, figs. 8-9) does not agree with the original measurements of 1845 and 1853, being 57 mm. long, 31 mm. wide, with the aperture 30 by 17.5 mm. In all probability it was drawn from the specimen (probably a cotype) in Pfeiffer's collection. This shell has the columella extensively reddish, except over the lower outer border, and is a good representation of some small or immature "*adelinae*" I have seen from Cameroon. In this connection it should be noted that Pfeiffer's original and later descriptions mention only that the columella has a purple line.

Reeve's figure of *papyracea* (1849), copied in my Pl. 23, fig. 1, shows a shell said to be from the Cuming Collection and agreeing closely with Pfeiffer's original measurements, being 68 mm. long, 37.5 mm. wide (Pfeiffer's original width of 30 mm. was clearly an oversight, probably for 36 mm.), with the aperture 36 by 20 mm. It shows no red on the columella. Moreover, in the letterpress to Pl. 2, Reeve gives a somewhat modified description of *papyracea* (English text only copied here): "Shell oblong-ovate, thin, whorls six in number, minutely decussately granulated, margined at the sutures, columella slightly twisted, but little truncated; light brown, clouded with darker brown, columella sometimes pinkish. A light, semi-transparent shell, of which the interior is slightly iridescent." The mention of the columella being "sometimes pinkish" no doubt was induced by the figure which shows the columella unicolorous bluish-white. The type lot at the British Museum, which I saw in 1933, comprises two shells, the larger of which was figured by Reeve; since its dimensions are practically those given in Pfeiffer's original description of 1845, there can be little doubt that this figured example is the true holotype. It seems strange therefore that Pfeiffer described the columella as streaked with purple, whereas Reeve's figure shows no trace of this.

Possibly the purple color was restricted to the extreme inner edge (as in some shells I have seen from Cameroon), so that it was not visible in a direct front view, and Reeve corrected the description from the figure, not from the shell. Unfortunately I failed to examine the types carefully enough for this peculiarity.

A. aurora Pfeiffer (1855) was known thus far only from the original description: "A. testa oblongo-ovata, solida, sublaevigata, fulvida, strigis sparsis, saturate castaneis variegata; spira conica, obtusa; sutura marginata; anfract. 6 convexiusculis, ultimo spiram subaequante; columella perarcuata, purpurea, basi late truncata; apertura parum obliqua, sinuato-ovali, intus lilaceo-rosea, nitida; perist. simplice, fusco-limbato, marginibus callo roseo intrante junctis. Long. 59, diam. 28 mill." The type, figured for the first time in my Pl. 81, fig. 1, is at the British Museum, where I saw it in 1933. It is an immature, much worn, possibly beach-rolled shell, of a little over 5 whorls. As Connolly (1912) remarked, no shell even remotely resembling this specimen has ever been found since in South Africa. The locality "Natal" must be erroneous, unless the shell had been brought there in ballast. It may be fairly matched with immature specimens of *A. papyracea*, with which it agrees in the color of columella and parietal wall, while the faded markings are of the type found in that species. I do not hesitate in including it among the synonyms of *A. papyracea*. Pilsbry (1904) first suggested that it was a West African shell.

Original description of *A. papyracea* var. *adelinae* Pilsbry (1905): "The shell is shaped like *papyracea*, much more slender than *knorrii*. Early whorls roseate, the last two pale yellowish-green, sparsely ornamented with deep chestnut flames, very few of them reaching the suture above, widening downwards. No subsutural tessellation. Surface smooth and glossy, very weakly decussate. Aperture less than 0.6 the shell's length, the columella short, narrow, quite concave and crimson. Length 68, diam. 35, aperture 37 mm." I have studied the two types at Ac.N.S.Phila. The larger of the two, here selected as the lectotype, is shown in Pilsbry's Pl. 20, fig. 5. I publish a photograph of this shell (Pl. 74, fig. 3). I have seen a fair number of specimens from Cameroon, some of them nearly identical with the types of *adelinae*, others departing from them in various details. Their study, together with a consideration of Pfeiffer's original description and Reeve's and Pfeiffer's figures of *A. papyracea*, has led me to conclude that *adelinae* is to be considered as a synonym of *papyracea*. Three differences may be noted between Reeve's figure and most examples of "*adelinae*." The most important of these is the color of the columella. But, as noted above, Pfeiffer's original description states

that the columella was streaked with purple, the usual condition in *adelinae*. On the other hand, in the shells from Cameroon, the extent of "purple" or rather "pinkish" (as Reeve calls it) on the columella varies a great deal, even in a lot from one locality, being sometimes limited to a very narrow inner line. I have also seen Cameroon shells without any trace of it, although they are otherwise like "*adelinae*." In Reeve's figure the whorls above the body-whorl are all light purplish. In the Cameroon "*adelinae*" the early whorls are pinkish to a varying extent, sometimes even over part of the penultimate whorl (but not over the whole of this whorl in any shells I have seen). The darker, chestnut-brown markings are rather obscure, narrow and irregularly wavy throughout in Reeve's figure, whereas in most "*adelinae*" they are more conspicuous, much widened and often confluent at the base, extending above the periphery as narrowed flame-like streaks which rarely reach the suture; but some Cameroon shells, not otherwise separable from "*adelinae*," do not conform to this pattern, approaching more *papyracea* as figured by Reeve.

Original description of *A. modestior* O. Boettger (1905) (German text translated): "Differt ab *A. knorri* Jon. spira graciliore, anfr. ultimo 4/7 altitudinis testae aequante, flammulis infrasuturalibus in illa crebris et distinctissimis hic tenuibus et evanidis vel subnullis, apert. multo minus alta, spiram vix superante. — *T. modica*, fusiformi-ovata, tenuiuscula, sub epidermide decidua, opaca, lutescente pallide straminea vel cornea, oleo nitens, versus apicem intense rosea, ab anfr. tertio flammis distantibus angustis, initio rectis, tum elegantissime fulguratis, obscure castaneis picta, flammis infra medium anfr. ultimi latis, aut versus basin confluentibus aut basi plene nigricante; spira elate conica lateribus vix convexiusculis; apex sat acutatus. Anfr. 6 sat convexiusculi, distincte striatis, lineis spiralibus impressis subtiliter decussati, sutura submarginata et distinctius striata disjuncti, ultimus ventriosior, basi spiraliter non striatus, 4/7 altitudinis testae subaequans. Apert. obliqua, truncato-ovalis, superne flammis albis perlucentibus picta, basi livide caeruleascens, intus margaritacea; perist. simplex, acutum, nigrolimbatum, marginibus callo tenui pelucido caeruleo-junctis; columella angusta, subverticalis, leviter protracta, albida et oblique intuenti saepe rosea vel purpurea, basi oblique truncata. Alt. 66–67, diam. max. 36½ mm.; alt. apert. 36–39, lat. apert. 22–24 mm. — Eggs: Alt. 15–15½, diam. max. 11–12 mm. This as yet unrecognized species resembles *A. knorri* Jonas of Liberia, but is undoubtedly specifically distinct. The spire is higher, the whorls are somewhat flatter, the body-whorl shorter and less swollen. Color and markings are similar, yet different in many particulars. Only the upper three whorls are fleshy-red, the remainder of the shell cor-

neous or straw-yellow, not bright yellowish-white; the dark hooked streaks below the suture, which are so numerous in *A. knorri*, are lacking or indicated only by faint dots or small streaks; the large flame-like markings on the middle whorls are vertical and are not oblique from right to left. On the other hand, the strong flame-like pattern of the last two whorls has the same character, except for the almost complete absence of flame-like spots at the sutures. The body-whorl has 10 to 12 such flame-like elongate markings. The columella has often a purple-red margin, which is always wanting in the true *A. knorri* Jonas. An example of the latter in my collection, from Liberia, has the length 68, the diameter $38\frac{1}{2}$ mm., the length of the aperture $44\frac{1}{2}$, the width of the aperture 22 mm., the proportion of length of aperture to length of shell being then 1 : 1.53 (in Pfeiffer 1 : 1.60). *A. modestior* on the contrary has the proportion 1 : 1.77. It is always separated with certainty from *A. marginata* Swainson, which lives mixed with it, by the smaller size, the thinner shell, the slender shape and the bright color and markings." In 1933 I examined several specimens of the type series at the Senckenberg Museum in Frankfurt, including the shell from Mukonje Farm figured by the author on Pl. 7, figs. 1-2; this shell was selected as the lectotype. One of the original figures is copied in my Pl. 60, fig. 1. It should be noted that this figured lectotype is larger than the measurements given in the description, being 78 mm. long, 43 mm. wide, with the aperture 44 by 24 mm. This specimen is not separable from Pilsbry's *A. adelinae*, as Pilsbry recognized later. Pilsbry's name has several months priority; but both names should now be regarded as synonyms of *A. papyracea*. However, some of O. Boettger's paratypes of *modestior*, particularly the shell he figured as a variety from Bibundi (Pl. 7, fig. 3), were of a different species and are referred in the present paper to *A. marginata eduardi* Pilsbry.

The adult shell of *A. papyracea* is medium-sized, less than 100 mm. in length, broadly ovate-oblong, light, thin but fairly solid, translucent, the darker pattern showing in the aperture; widest usually a little below mid-length, or at lower third. Spire much raised, considerably narrower than base, forming a wide cone, ending in a broadly rounded, dome-shaped apex. Whorls 6 to $6\frac{1}{2}$, moderately and increasingly convex from the third on, with narrow, shallow sutures. Flattened subsutural area often starting on the fourth whorl, but most pronounced on the body-whorl, varying in width, set off more or less by an impressed line, sometimes wanting. Upper 3 whorls (including nepionic shell) forming a hemispherical dome, the first scarcely flattened; next whorls gradually increasing in length and width. Body-whorl very long, about three-fourths of the total length of the shell

in front view, moderately obese, often little more convex than penultimate whorl. Aperture rather narrow, about half the total length of the shell or slightly longer, semi-elliptical; outer margin evenly and moderately curved. Inside bluish-white, also along the inner edge. Outer lip thin, sharp, not at all expanded nor flaring. Parietal wall with a very thin, bluish-white glaze, sometimes partly vinaceous-red below, toward the columella. Columella very narrow, more or less concave or somewhat twisted, gradually narrowed below to the oblique truncation, which is placed much above the base of the aperture; usually with a vinaceous-red inner edge, varying greatly in extent, but rarely covering the entire columella; in a few shells from Cameroon, not differing otherwise from those with reddish columella, this is entirely bluish-white; but whether this was true in life remains to be determined. In the youngest shell seen, 18 mm. long, of $3\frac{1}{2}$ whorls (Pl. 5, fig. 1), most of the nepionic whorls densely covered with minute granulations in spiral rows, except the first which is very finely vertically wrinkled. Granulation about the same or a little stronger on the next whorls, as far as the first half of the fourth, but never visible to the naked eye; beyond this decreasing rapidly in strength. Penultimate and body-whorl of full-grown shells appearing smooth, but under the lens with superficial granulations, which extend also below the periphery to near the columella; sculpture more distinct below the sutures, where there are several spiral rows of minute granulations. Periostracum thin, shiny, pale straw-yellow, usually well preserved, except on the early whorls. First three or four whorls (rarely more) pink to pale vinaceous-red, with rather faint darker vertical streaks from the latter part of the third on. Succeeding whorls with chestnut-brown, usually very bold, vertical streaks, extremely variable in shape, width and length, as a rule fairly evenly spaced and slightly wavy; sometimes broken up into spots. Below the periphery the streaks tend to be broader and to unite at the base in the columellar region; the transition between the narrower and broader portions may be gradual, the streaks ending flame-like at or more often some distance below the suture; sometimes the streaks widen abruptly at the periphery or only a few of them extend above it; occasionally they combine below the periphery, most of the lower half of the body-whorl being chestnut-brown (somewhat as in *A. marginata egregia*). In very young shells (18 mm. or less in length), the columella has a narrow open slit, but is distinctly truncate at the base; the slit is no longer present in a shell 28 mm. long. The egg is as yet unknown.

Specimens Examined. Several from "West Africa" (Ac.N.S.Phila., No. 185105, lectotype and paratype of *adelinac*; A.M.N.H.; M.C.Z.).—CAMEROON: Yaunde (M.C.Z.; Mich.M.; Ac.N.S.Phila.; Brus.M.);

Lolodorf (E. D. Horner.-M.C.Z.); Etome (P. Dusén.-Stockh.M.; M.C.Z.); Edea (G. Schwab.-M.C.Z.); Bakundu Kaki near Elephant Lake (R. Rohde.-Hamb.M.; M.C.Z.); Tyange near Kribi (E. D. Horner.-M.C.Z.); Kribi (Leid.M.).

The species was originally described from the "Nun River," with which was meant no doubt the Nun Entrance of the Niger, in Southern Nigeria (4° 21' N.; 6° 4' E., some 200 miles to the west of Mt. Cameroon); otherwise it is known with certainty only from Cameroon. The M.C.Z. has a shell from an old collection labelled "Gaboon," which I regard as a very doubtful locality.

Measurements of Adult Shells

Length	Greatest	Aperture		Whorls	
	Width	Length	Width		
79 mm.	43	45.5	23.5	6½	Yaunde
78.5	43.5	45.5	23.5	6½	"
77	40.5	42	22	6½	Lolodorf
76	39.5	41	22	6½	Yaunde
71	35	36.5	20	6	Lolodorf
69	38.5	39	21	6	"
67	39	38	21.5	6	Kribi
65	33.5	35.5	18.5	6	Lolodorf

ARCHACHATINA (MEGACHATINOPSIS) PURPUREA (Gmelin)

Pl. 4, fig. 1; Pl. 6, fig. 2; Pl. 8, fig. 3; Pl. 11, fig. 1; Pl. 24, fig. 1; Pl. 25, fig. 2; Pl. 39, fig. 4; Pl. 58, fig. 1; Pl. 61, fig. 1; Pl. 62, fig. 4; Pl. 64, fig. 3; Pl. 68, fig. 2; Pl. 72, figs. 1-2.

[Lister, 1688, Synopsis Method. Conchyl. Liber Quartus, Pl. 581, fig. 35 (shell in front view, 85 mm. long, 52 mm. in greatest width, the aperture 45 by 27 mm.).]

[*Bulla purpurea*, etc. Chemnitz, 1786, Syst. Conch.-Cab., 9, pt. 2, p. 25; Pl. 118, figs. 1017-1018 (supposedly from the Gold Coast; descriptions and figures of 2 specimens). Not binominal].

Bulla purpurea Gmelin, 1790, in Linné, Syst. Nat., 13th Ed., 1, pt. 6, p. 3433 ("in Africae campis"; with description and a reference to Chemnitz, Pl. 118, figs. 1017-1018, to which figures the name is herewith restricted). Schreibers, 1793, Versuch Conchylienkenntniss, 1, p. 90. Turton, 1806, in Linné, System of Nature, Animal Kingdom, 4, p. 357. Dillwyn, 1817, Descr. Cat. Recent Shells, 1, p. 495. Wood, 1818 (and 1825), Index Testaceologicus, p. 89; Pl. 18, fig. 54. Mawe, 1823, Linnaean Syst. Conch., p. 102. Wood, 1856, Index Testaceologicus, Hanley Ed., p. 95; Pl. 18, fig. 54.

- Ampulla purpurea* Röding, 1798, Museum Boltinianum, **2**, p. 110 (with reference to Chemnitz, Pl. 118, figs. 1017–1018); 1819, *Op. cit.*, 2d Ed. (by J. Noodt), p. 78.
- Helix* (*Cochlitoma*, *Achatina*) *purpurea* Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 49 (or 53) (with *Bulla purpurea* Gmelin and *Bulimus purpurascens* Bruguière as synonyms; and with reference to Chemnitz, Pl. 118, figs. 1017–1018).
- Achatina purpurea* Lamarck, 1822, Hist. Nat. Anim. Sans Vert., **6**, pt. 2, p. 128. Menke, 1828, Synopsis Method. Moll., p. 16; 1829, Verzeichn. Conch.-Samml. Walsburg, p. 7. Deshayes, 1831, Dict. Class. Hist. Nat., Atlas, Pl. 87 (unnumbered), figs. 1–2 (2 views of one shell). Potiez and Michaud, 1835, Gal. Moll. Douai, **1**, p. 130; Pl. 12 (dated November, 1835), figs. 3–4 (2 views of one shell). "Coast of Malaguette" [= Liberia!]; 1844, *Op. cit.*, Atlas, Explanation of Plates, p. 13. Jay, 1835, Cat. Shells Coll., p. 31 ("*perpurea*"); 1836, *Op. cit.*, 2d Ed., p. 42. Deshayes, 1838, in Lamarck, Hist. Nat. Anim. Sans Vert., 2d Ed., **8**, p. 296; 1838, in Cuvier, Le Règne Animal, 3d Ed., Mollusques, Pl. 25, fig. 2. Jay, 1839, Cat. Shells Coll., 3d Ed., p. 58. Hanley, 1840, Young Conchologist's Book Species, p. 36. Pfeiffer, 1840, Krit. Register Konch.-Kab., p. 84; 1841, Symbolae Hist. Helic., **1**, p. 28. Deshayes, 1844, in Lamarck, Hist. Nat. Anim. Sans Vert., 3d Ed., **3**, p. 375. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 166. Porro, 1846, Cat. Mus. Modiol., Moll. Terr. Fluv., p. 17. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 253. Reeve, 1848, Conch. Icon., **5**, *Achatina*, Pl. 4, fig. 15b only (Liberia: Cape Palmas). Gould, 1850, Proc. Boston Soc. Nat. Hist., **3**, p. 195 (Liberia: Cape Palmas, near the coast only). Mörch, 1850, Cat. Conchyl. Kierulf, p. 7. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, p. 161 (in part; not the figures). Mörch, 1852, Cat. Conchyl. Yoldi, p. 20. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 483. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 132. Pfeiffer, 1857, Syst. Conch.-Cab., **1**, Abt. 13, pt. 1, p. 292; Pl. 2, figs. 6–7 (copies of Chemnitz' Pl. 118, figs. 1017–1018). Morelet, 1858, Séries Conchyl., **1**, p. 19 (Ivory Coast: Grand Bassam). Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 601. A. D. Brown, 1861, Cat. Shells Coll., p. 56 (Liberia: Cape Palmas). Gould, 1862, Otia Conchol., p. 208. Mörch, 1863, Cat. Conchyl. Lassen, p. 4. Bielz, 1865, Verzeichn. Moll. Conch.-Samml., 3d Ed., p. 23. Haines, 1868, Cat. Terr. Shells Coll., p. 68. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 213. Paetel, 1869, Moll. Syst. Cat., p. 80; 1873, Cat. Conch.-Samml., p. 99. Fridrici, 1874, Bull. Soc. Hist. Nat. Metz, **13**, p. 184. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 273. Roeters van Lennep, 1876, Cat. Coll. Shells van Lennep, p. 53. G. R. Batalha, 1878, Cat. Coll. Conchyl. F. R. Batalha, p. 1. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 145. Grasset, 1884, Index Test. Viv. Coll., p. 199. Rethaan Macaré, 1888, Cat. Coll. Coq. Mme Rethaan Macaré, p. 23. Vignon, 1888, Bull. Soc. Mal. France, **5**, p. 69 (Ivory Coast: Grand Bassam; Assinie). Schepman, 1888, Notes Leyden Mus., **10**, p. 247 (Liberia: Schieffelinville). Martorell y Peña, 1888, Catálogo Colección Conchol. Museo Martorell, Barcelona, p. 56. Bourguignat, 1889,

- Moll. Afr. Equat., p. 77. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., 2, p. 240. Büttikofer, 1890, Reisebilder aus Liberia, 2, pp. 454 and 481. Boucard, 1901, Cat. Coll. Coquilles Terr., p. 49. Johnston, 1906, Liberia, 2, p. 861. Julia E. Rogers, 1908, The Shell Book, p. 275 ("purpura"). Connolly, 1928, Ann. Mag. Nat. Hist., (10), 1, p. 540 (Sierra Leone: Tombo; Kaiyima).
- Cochlitoma purpurea* G. B. Sowerby, 1825, Cat. Shells Earl Tankerville, p. 38.
- Achatina (Cochlitoma) purpurea* Menke, 1830, Synopsis Method. Moll., 2d Ed., p. 28.
- Agathina purpurea* Deshayes, 1831, Dict. Class. Hist. Nat., 17, p. 122 (Explanation of Pl. 87, fig. 1, of Atlas).
- Helix (Cochlitoma) purpurea* Rang, 1831, Ann. Sci. Nat., 24, p. 27 (in part: Coast of Malaguette [=Liberia], particularly at the Mesurado [=Monrovia], Sestre and Sino Rivers. Animal and egg).
- Achatina (Achatina) purpurea* Beek, 1837, Index Moll., pt. 1, p. 75. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 208 (Malaguette [=Liberia]).
- Bulimus (Achatina) purpurea* Anton, 1839, Verzeichn. Conch. Samml., p. 44.
- Oncaea purpurea* Gistel (or Gistl), 1848, Naturgesch. d. Thierreichs, p. 168; Pl. 5, fig. 26.
- Achatina (Archachatina) purpurea* Albers, 1850, Die Heliceen, p. 190.
- Achatina (Achatinus) purpurea* Pfeiffer, 1856, Malak. Blätt., 2, (1855), p. 168; 1879, Nomencl. Helic. Viv., p. 265. Römer, 1891, Jahrb. Nassau. Ver. Naturk., 44, p. 123.
- Achatina (Urceus) purpurea* Mörch, 1857, Cat. Conch. Suenson, p. 6.
- Archachatina purpurea* Pilsbry, 1905, Man. of Conch., (2), 17, p. 114 (Liberia: Cape Palmas); Pl. 21, figs. 6-7 (2 specimens). Kobelt, Abh. Senckenberg. Naturf. Ges., 32, p. 66. Standen, 1917, Jl. of Conch., 15, pt. 6, p. 161 (egg). Lamy, 1929, Jl. de Conchyl., 73, p. 202 (egg).
- Archachatina (Megachatinops) purpurea* Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., 29, pt. 1, p. 93 (in part: some of the references only. Liberia: Monrovia; Cape Palmas).
- Bulimus purpurascens* Bruguière, 1792, Encyclop. Méthod., Vers, 1, pt. 2, p. 360 (no locality; description of a shell; references to Lister, Pl. 581, fig. 35, and to Chemnitz, Pl. 118, figs. 1017-1018, only).
- Achatina erythrostoma* Swainson, 1822, Cat. Shells Coll. Mrs. Bligh, pp. 44 and 51 (no description); Appendix, p. 14 (no locality; with description and reference to *Bulla purpurea* Chemnitz, Pl. 118, figs. 1017-1018, and to *Bulimus purpurascens* Bruguière).
- Achatina porphyrostoma* Shuttleworth, 1852, Mitth. Naturf. Ges. Bern, Nos. 248-249, p. 201 ("West Coast of Africa"; described from 3 shells). Pfeiffer, 1853, Monogr. Helic. Viv., 3, p. 483. H. and A. Adams, 1855, Gen. Rec. Moll., 2, p. 132. Pfeiffer, 1859, Monogr. Helic. Viv., 4, p. 601; 1868, Op. cit., 6, p. 213; 1877, Op. cit., 8, p. 273. Grasset, 1884, Index Test. Viv. Coll., p. 199. Bourguignat, 1889, Moll. Afr. Equat., p. 77. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., 2, p. 240.
- Achatina (Achatinus) porphyrostoma* Pfeiffer, 1879, Nomencl. Helic. Viv., p. 265.
- Archachatina porphyrostoma* Pilsbry, 1905, Man. of Conch., (2), 17, p. 115. Kobelt, 1910, Abh. Senckenberg. Naturf. Ges., 32, p. 66.

Archachatina (Megachatinops) porphyrostoma Bequaert and Clench, 1936, Rev. Zool. Bot. Afric., **29**, pt. 1, p. 93.

Achatina viridescens Ancy, 1888, Bull. Soc. Mal. France, **5**, p. 69, footnote (Liberia: Monrovia).

The first recognizable figure of what might be called the "least purple-mouthed agate snail" is that of Lister (1688; reproduced in my Pl. 11, fig. 1), as Lamarck (1822) correctly indicated; it shows both the coarse sculpture and the outline characteristic of the species. Gmelin (1790) based his *Bulla purpurea* on two figures by Chemnitz (1786) and one figure in Knorr's (1769; 1770) work. The description, seemingly made not from a specimen but from the figures, is as follows: "B. testa ventricosa rugosa longitudinaliter strigosa intus purpurea; columella truncata, apertura ovata labro acuminato: limbo intus nigrissimo." Chemnitz's two figures (copied in my Pl. 24, fig. 1, and Pl. 72, fig. 2), cited first by Gmelin, are herewith selected as typical for *A. purpurea*, since they agree well with some of the specimens of what has been more generally regarded as this species, particularly by Pilsbry, the first reviser of the group. Fig. 1017 shows a shell from the back, 70 mm. long and 45 mm. in greatest width, with the olivaceous periostracum and the coarse decussation well preserved. Fig. 1018, on the other hand, is a front view of a shell, 74 mm. long, 48 mm. in greatest width, with the aperture 43 by 23 mm. This shell had been, in Chemnitz's own words, "well polished and somewhat ground,"¹ which explains the different color and the smoothness. Although Chemnitz states that he received his specimens from a ship's surgeon who brought them from the Gold Coast, no true *purpurea* are known with certainty at present from the restricted section of West Africa now called the Gold Coast. Either the term was used more loosely in the early days or the shells were obtained farther West in the course of a journey to the Gold Coast, where the main Danish trading posts were located at that time. Chemnitz's specimens have not been traced, although they may yet be in some collection.

Lister's and Chemnitz's figures are readily matched with Liberian specimens of *purpurea* (compare Pl. 8, fig. 3). However, Knorr's Pl. 24***, fig. 1 (reproduced in my Pl. 61, fig. 5), also cited by Gmelin for his *Bulla purpurea*, represents in my opinion a very different species. I discuss this figure under *A. ventricosa spectaculum* Pilsbry, as well as the figure referred to *purpurea* by Deshayes (1851, in Férussac).

Bulimus purpurascens was described by Bruguière (1792) as follows (French text translated): "*Bulimus*, testa ovata ventricosa decussata, viridescens, fusco strigata, columella arcuata, apertura purpurascens.

¹ "mit ihrer wohlpolirten und etwas abgeschliffenen Schale."

This *Bulime* differs from the *Bulime perdris* [= *Achatina achatina* Linné] only in the following characters. 1. The shell is always smaller than in the other, consisting of 6 whorls only; the entire surface covered with a dense network of fine and closely set crossing striae, which make it slightly granulose. 2. The lower whorl of the spire [body-whorl] bears on the middle of its convexity [at the periphery] a perfectly smooth transverse band on which are seen but a few longitudinal striae even weaker here than elsewhere. 3. The aperture is similar to that of the *Bulime perdris*, as well for the two lips as for the general shape and the oblique truncation of the columella, but both its margins and the bottom of the cavity [aperture inside] are purple, only with the difference that the color of the outer walls [outer lip] is slightly less intense than that of the left side [parietal wall and columella]. 4. The shell is greenish outside and marked at intervals with a number of brown longitudinal [vertical] zones marking the several additions by growth. The apex is very obtuse and the last three whorls [apical whorls] are flesh-color. It is also to be noted that the rim of the right lip [outer lip] is very thin and bears inside a brown transparent zone, which Chemnitz described as black in his shell." Unfortunately no measurements are given and the type appears to be lost. Bruguière cites figures by Lister (Pl. 581, fig. 35) and by Chemnitz (Pl. 118, figs. 1017-1018), which, in my opinion, represent true *A. purpurea* Gmelin, as well as by Knorr (Pl. 24***, fig. 1), the latter here referred to a form of *A. ventricosa*. Nevertheless *A. purpurascens* may safely be synonymized with *A. purpurea*, since the description agrees well with this species. Moreover, two early French authors, Férussac (1821) and Lamarck (1822), treated *purpurascens* as a synonym of *purpurea*. They may have been acquainted with Bruguière's type, although they do not say so.

Achatina erythrostoma Swainson (1822) was clearly intended to be a substitute name for *purpurea* and *purpurascens*, although it was accompanied by the following description: "A. testa ob-ovata, subtilissime cancellata, epidermide olivaceo-flava; spira obtusa; apertura labioque interiore rubris, margine fusca. Shell obovate, with very fine cancellated striae, epidermis yellowish-olive; spire obtuse; aperture and inner lip red; the margin brown." The description is vague, but contains nothing that could not be applied to what is here called *purpurca*. Unfortunately no measurements were given. I have been unable to discover what became of the type.

Since Gmelin's time the trivial name *purpurea* has no doubt been applied sometimes to other purple- or pink-mouthed species of *Archachatina*, such as *A. ventricosa* (Gould), *A. rhodostoma* (Philippi), and *A. degneri* Bequaert and Clench. Except in the few cases where the

shells were figured or preserved to this day, it seems impossible to decide what was actually recorded under the name. For this reason I have included most published references to *purpurca* in my bibliography of this species. Rang's (1831) *purpurca* was a mixture of that species, *ventricosa* and possibly *rhodostoma*, or perhaps even *degneri*. The only size he gives is that of his largest shells (150 to 190 mm.), which exceeds by far that of any true *purpurca* I have seen. Reeve's (1848) Pl. 4, fig. 15a, appears to represent *A. degneri*, where I have listed it, not *A. ventricosa* as Pilsbry suggested with doubt. Pilsbry recognized his *A. rhodostoma* var. *splendida* in Reeve's (1842) Pl. 176, fig. 1. Philippi (1849) compared his *A. rhodostoma* with a supposed *purpurca*, which seems to have been *A. ventricosa*.

Shuttleworth (1852) first noticed that more than one species was being confused under *purpurca*. Unfortunately he redescribed small, slender specimens of true *purpurca* as his new *A. porphyrostoma*, as shown by his description, one of the best ever written of the species: "Testa ovato-oblonga, solidiuscula, striata, lineisque granulosis spirali-bus crebris decussata, olivacea, strigis maculisque fuscis marmorata; spira ovato-conoidea, obtusa, purpureo-rosea; anfr. 6, convexiusculi, ultimus vix inflatus, 3/5 longitudinis aequans; sutura impressa marginata, crenulata; columella arcuata, purpurea, basi oblique truncata; apertura mediocris, semiovalis, intus lilacina; perist. acutum, simplex, marginibus callo tenuissimo nitido purpurascente introrsum effuso junctis. Long. 60; Diam. 32 mill. Apert. 32 longa, 20 lata." His unfigured types should be at the Bern Museum. My Pl. 68, fig. 2 shows a specimen agreeing well with his description. The supposed *A. purpurca*, with which Shuttleworth compared his *porphyrostoma*, were *A. degneri*, as I have shown under that species.

A. viridescens Ancey was briefly described as follows (translated from the French): "Smaller, more granulose [than *A. purpurca*, supposedly], with the body-whorl shorter and much more ventricose; mouth smaller, peristome less expanded, usually marked with a darker streak, inside of a deeper purplish, the periostracum constantly glaucous greenish." No measurements were given. I have seen two of Ancey's cotypes, one at the Tervuren Museum, the other now at the Brussels Museum. They do not differ in sculpture, shape, color or size from typical *purpurca*. One is 87.5 mm. long, 53 mm. in greatest width, of 6 whorls, with the aperture 50 by 31 mm. (Brus.M.), and is shown in my Pl. 6, fig. 2. Ancey evidently compared his *viridescens* with *A. ventricosa*, which occurs in the same general area and which he mistook for the true *purpurca*.

Connolly (1928) mentions an interesting variation of *purpurca* with a plain yellow shell, from Kaiyima, Sierra Leone.

Standen (1917) states that the eggs of *A. purpurea* are very large, 18 by 12.25 mm., yellowish-white. Those I saw from Cape Palmas were smaller, 14.5 to 15.5 mm. long and 10.4 to 10.6 mm. wide, regularly elliptical. Standen's eggs may have been those of *A. ventricosa* or *A. degneri*.

What I regard as true *A. purpurea* agrees with Pilsbry's (1905) interpretation of the species, as shown by his description and figures. Shell medium-sized, not reaching 100 mm., lengthened ovate-oblong, solid, opaque, widest at about lower third. Spire much raised, considerably narrower than the base, forming a wide cone, ending in a broadly rounded, dome-shaped apex. Whorls 6 to $6\frac{3}{4}$, markedly and increasingly convex from the third on, with narrow, moderately deep sutures. Flattened subsutural area of body-whorl broad, set off by a deeply impressed line, which starts on the penultimate whorl. Upper 3 whorls (including nepionic shell) forming a hemispherical dome, the first whorl flattened; following whorls gradually increasing in length and width. Body-whorl long, obese, more convex than penultimate whorl, from two-thirds to three-fourths of the total length of the shell in front view. Aperture short, wide, nearly semi-circular, slightly over half the total length of the shell; outer margin strongly but evenly curved. Inside varying from pale vinaceous-red to dark purple, usually with a broad blackish purple inner edge. Outer lip thin, sharp, neither expanded nor flaring even in the largest shell seen, very slightly produced forward in profile, not descending at the insertion on the body-whorl. Parietal wall with a purplish-red glaze. Columella purplish-red, broad, sharply truncate close to the base of the aperture. Purple area of parietal wall and columella often with a narrow, darker purplish-brown outer edge on the body-whorl. Youngest shell seen, 18.5 mm. long, of $3\frac{1}{2}$ whorls (Pl. 4, fig. 1), with nepionic whorls densely granulose in regular spiral, but rather ill-defined vertical rows, except the first whorl, which is very finely, vertically wrinkled; early sculpture usually worn off in part or entirely on adult shells. Granulations covering the whole of the following whorls, gradually coarser, easily seen with the naked eye on the body-whorl, where they extend to the edge of the outer lip and to the base of the columella, though weaker and more superficial below the periphery; on the body-whorl they also tend to be lengthened into short, somewhat curved, vertical welts. Periostracum thin, dull, pale olivaceous-yellow, usually lost on the early whorls, which are then pinkish to light vinaceous-red and marked with rather faint darker red vertical streaks. Penultimate and body-whorl of adult shells with nearly straight, narrow, dark-brown vertical streaks or lines, irregularly spaced and varying greatly in numbers, and in addition with a scattering of dark dots or blotches. In very young shells

the columella has an open slit, though it is distinctly truncate; the slit closes before the shell reaches 23 mm. in length.

Specimens Examined. Several from "West Africa" (Ac.N.S.Phila.; U.S.N.M.; M.C.Z.). — LIBERIA: without more precise locality (Leid.M.; Amst.M.; M.C.Z.; U.S.N.M.; Brit.M.); Monrovia (J. Bequaert.-M.C.Z.; Brus.M., including cotype of *A. viridescens*; Terv.M.; Leid.M.; Hamb.M.); Cape Palmas (U.S.N.M.; M.C.Z.; Ac.N.S.Phila.; A.M.N.H.). — SIERRA LEONE: Mano Bonjeima, Manoba Krim Chiefdom (T. S. Jones.-M.C.Z.); Dama, S. E. of Pujehun (T. S. Jones.-M.C.Z.); Kale, Mesi Krim Chiefdom (T. S. Jones.-M.C.Z.); Mosente on Lake Kwarko, Kwarko Krim Chiefdom (T. S. Jones.-M.C.Z.); these localities are all in the southeastern coastal area, between Sherbro Id. and the Mano River.

True *A. purpurea* is known with certainty only from the coastal areas of Sierra Leone, Liberia and the Ivory Coast. During my two visits to Liberia, I never observed it in the interior of the country, although it is quite common in the city of Monrovia. Many so-called *purpurea* in collections are misidentified; but some contain true *purpurea* with erroneous localities, such as "Gaboon."

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
89.5 mm.	51	50	28	6 $\frac{3}{4}$	Cape Palmas	
88.5	51	51	30	6 $\frac{3}{4}$	Liberia	
88	52	48.5	27	6 $\frac{3}{4}$	Monrovia	
87.5	53	50	31	6	Monrovia; cotype of <i>viridescens</i>	
84	49	48	26	6 $\frac{1}{2}$	Liberia	
82	47.5	47	26	6 $\frac{1}{2}$	"West Africa"	
77	45	43	25	6 $\frac{1}{3}$	Liberia	
74	39.5	36.5	21.5	6	Cape Palmas	
73	40	40	21	6 $\frac{1}{3}$	"West Africa"	
66.5	37	35	20	6	Cape Palmas	

4. Subgenus THOLACHATINA, new

J. Thiele (1933, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 296) first recognized that Achatininae with the conchological characters of the West African *Archachatina* were also found in East Africa. In the present paper I transfer to that genus, but in a distinct subgenus, the majority of the South African and several of the East African species

thus far included in *Achatina* or *Cochlitoma*. These species all have the broad dome-shaped or bulbous nepionic whorls, correlated with the production of unusually large eggs, both features being characteristic of *Archachatina*. As in the West African species, the nepionic whorls are densely granulose upon hatching and this sculpture is often well preserved in adult shells, though occasionally worn off. The other shell characters are mostly those of the subgenus *Megachatinopsis*, the outer lip in particular being simple, either with a sharp or a more or less thickened edge, but never flaring nor expanded. The distinctive features of the subgenus are the more elongate shape and the slender, more narrowly conical spire. In the subgenotype, the body-whorl is relatively broad, contrasting with the attenuate spire. The majority of the species, however, are narrow and slender throughout, being similar in appearance to *Limicolariopsis*, which has likewise a broad, dome-shaped nepionic shell. They differ, moreover, from the latter in the distinctly truncate columella. The sculpture varies greatly on the post-nepionic whorls, some species (such as the subgenotype) being coarsely granulose or decussate over the entire adult shell, others (such as *ustulata*) nearly smooth on the body-whorl. In one species (*vestita*) the sculpture is concealed by a thick periostracum, which is raised into many soft vertical ridges. The shells are small to medium-sized (40 to 135 mm. in length) and consist of many whorls for the size (5 to 7 in the smaller forms, as many as 8 to 9 in the larger ones, in the adult), shorter and more tightly coiled than in most West African species of the genus.

Subgenotype: *Achatina zebra* var. *granulata* Krauss, 1848 = *Achatina granulata* Pfeiffer, 1854. I have chosen this species as the type because it is likely to be in most collections. It is the largest member of the group.

I include at present in *Tholachatina* the following species of which I have seen specimens. No attempt is made, however, to revise them critically. Their number will no doubt be somewhat reduced eventually. Three species are here described as new; the anatomy of one of these has been studied by Dr. Mead.

1. *A. burnupi* (E. A. Smith, 1890).
2. *A. churchilliana* (Melvill and Ponsonby, 1895).
3. *A. cinnamomca* (Melvill and Ponsonby, 1894).
4. *A. dacostana* (Preston, 1909).
5. *A. dimidiata* (E. A. Smith, 1878). With subsp. *schencki* (v. Martens, 1889).
6. *A. drakensbergensis* (Melvill and Ponsonby, 1897).
7. *A. granulata* (Krauss, 1848). Pl. 62, fig. 2 (summit).
8. *A. livingstonei* (Melvill and Ponsonby, 1897).

9. *A. machachensis* (E. A. Smith, 1902).
10. *A. meadi* J. Bequaert, 1950. See below.
11. *A. neumanni* Thiele, 1933.
12. *A. obtusa* (Connolly, 1931).
13. *A. osborni* (Pilsbry, 1919). With subsp. *afromontana* (Bequaert and Clench, 1934).
14. *A. pentheri* (Sturany, 1898). With subsp. *subcylindrica* (Preston, 1909).
15. *A. sandgroundi* J. Bequaert, 1950. See below.
16. *A. semidecussata* (Pfeiffer, 1846).
17. *A. semigranosa* (Pfeiffer, 1861).
18. *A. simplex* (E. A. Smith, 1878). With subsp. *crawfordi* (Morelet, 1889) (Synonyms: *A. oedigyra* Melvill and Ponsonby, 1894; *A. zebra* v. Martens, 1900).
19. *A. stefaninii* (Connolly, 1925).
20. *A. transvaalensis* (E. A. Smith, 1878).
21. *A. ustulata* (Lamarck, 1822) (Synonym: *A. rhabdota* Melvill and Ponsonby, 1898).
22. *A. vestita* (Pfeiffer, 1855).
23. *A. weberi* J. Bequaert, 1950. See below.
24. *A. zuluensis* (Connolly, 1939).

Bulimus subgenus *Omphalostyla* Schlüter (1838, Kurzgefasstes Syst. Verz. Conchyliensamml., p. 7; with brief description) was monotypic for *Bulimus ustulatus* Menke, 1830. Unfortunately it does not seem possible to accept this name for my new subgenus of South and East African *Archachatinae*. Menke's *Bulimus ustulatus* was introduced without a description, but with a doubtful reference to *Achatina ustulata* Lamarck, which I here include in *Tholachatina*. Since Menke grouped it with *Bulimus kambeul*, most probably his specimen of *ustulatus* was a *Limicolaria*, as P. Fischer surmised (1892, Jl. de Conchyl., 40, p. 210). Schlüter does not group *Omphalostyla* with the species of *Bulimus* to which he attributes a truncate columella. His description, "Spindelrand perpendicular eingerollt," fits species of *Limicolaria*, but not *Achatininae* with a truncate columella.

ARCHACHATINA (THOLACHATINA) SANDGROUNDI, new species

Pl. 2, fig. 3; Pl. 6, fig. 4; Pl. 20, fig. 4; Pl. 57, fig. 3

Adult shell small, slender, subulate or narrowly clavate, widest at lower third, the upper part of the body-whorl and the spire forming one broad cone with very blunt apex; imperforate, thin but fairly solid, translucent, showing the markings somewhat within the aperture,

dull when fresh. Whorls 7, slightly convex, separated by narrow, weakly impressed sutures, those of the apex forming a broad, nearly hemispherical dome; the first flattened or even depressed, remainder gradually increasing in length and width. Body-whorl long and narrow, about two-thirds of the total length of the shell in front view, not more convex than penultimate whorl. Aperture long, but fairly wide, acuminate-ovate, much less than half the total length of the shell, with evenly curved, semi-elliptical outer margin. Inside white. Outer lip thin, sharp. Parietal wall with a very thin, white callus. Columella white, long and narrow, fairly strongly but evenly concave, obliquely truncate a short distance from the base. First whorl worn in all examples seen (probably at least in part granulose); second and third with distinct, granulose decussation; on the fourth the granulations turn into vertically elongate welts; from the fifth on the transverse engraved lines gradually weaken, being very superficial over the terminal half (above the periphery) of the body-whorl; below the periphery the body-whorl has only faint growth-striae, but the transition at the periphery is very gradual; growth-striae coarse below the finely and superficially crenulate sutures. Periostracum, when preserved, very thin, dull, pale yellowish. Apical three whorls dull reddish-yellow; remainder of shell straw-yellow with reddish-brown or chestnut vertical streaks, straight, oblique or more or less wavy, usually narrowed toward the upper sutures, occasionally broken up, increasing in size toward the body-whorl.

A. sandgroundi has the shape of a *Limicolariopsis*, from which it is readily differentiated by the truncate columella. It is most closely related to *Archachatina ustulata* (Lamarck) and *Archachatina pentheri* (Sturany), both of which are larger for the same number of whorls. *A. ustulata* is also broader, with the summit not so broadly flattened dome-like, with less concave columella, and with the decussate sculpture weaker, the body-whorl of full-grown shells being almost smooth. *A. pentheri* has about the shape of *sandgroundi*, but the whorls are more convex and the sculpture is coarser, the decussation being strong over the entire upper half of the body-whorl of the largest example seen (70 mm.; of 7 whorls).

This new species was determined as *Achatina vassei* Germain by one malacologist and is found under that name in some collections. The true *vassei*, the type of which I saw at the Paris Museum in 1933, is, however, in no way related. It is a thin shell, with acuminate, narrow apex, allied to *Achatina eracni* E. A. Smith, and apparently of the subgenus *Lissachatina* in the genus *Achatina*.

Specimens Examined. SOUTHERN RHODESIA: Mt. Selinda, Chirinda Forest, holotype (M.C.Z. No. 82445) and four paratypes (M.C.Z. No. 94745); collected by Dr. J. Sandground.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
58.5 mm.	23	24.5	13	7		Paratype
57.5	22.5	24	11.5	7		Holotype
57	23.5	25.5	11.5	7		Paratype
56.5	24	26	13	7		"
55.5	22	24	11.5	6½		"

ARCHACHATINA (THOLACHATINA) MEADI, new species

Pl. 23, fig. 5; Pl. 77, fig. 1

Adult shell small, elongate-ovate, widest below mid-length, the spire forming a broad, short cone ending in a bluntly rounded apex; imperforate, thin but fairly solid, translucent, showing the markings very distinctly within the aperture, dull. Whorls $6\frac{1}{3}$ to 7, decidedly and increasingly convex from the fifth on, separated by narrow, deeply impressed sutures; first very slightly raised; upper three (including the nepionic shell) forming a moderately wide bulbous apex; remainder increasing rather rapidly in width and length. Body-whorl long and narrow, about two-thirds of the total length of the shell in front view, slightly more convex than penultimate whorl. Aperture long, moderately wide, about half the total length of the shell, with strongly but evenly curved, semi-elliptical outer margin. Inside white. Outer lip thin, sharp. Parietal wall scarcely glazed, without callus, the markings being as distinct there as elsewhere. Columella white, long and very narrow, nearly straight but somewhat oblique, distinctly and obliquely truncate very close to the base. In a young shell (Pl. 77, fig. 1) 41 mm. long, of 5 whorls, nepionic whorls densely and finely granulose, except for the nearly smooth earliest third of the first whorl; nepionic sculpture preserved in all adult shells seen. Post-nepionic whorls coarsely decussate and at first granulose; from the fifth whorl on with short, vertical welts, gradually increasing in strength; body-whorl with strong sculpture over the upper half, much more weakly decussate below the periphery to close to the base. On 5th to 7th whorls, growth-striae becoming coarse folds below the sutures, crenulating them superficially. Periostracum very thin, pale yellowish, dull, well preserved in all specimens seen. Apical 2 whorls (nepionic shell) unicolorous, dirty pale yellowish; remainder of shell straw-yellow, with many reddish-brown or chestnut markings, in the shape of narrow, oblique or wavy streaks on the earlier whorls; from the fifth on streaks mostly broken up irregularly into spots or blotches; below periphery

of body-whorl, streaks more complete, with jagged edges and usually connected with a fairly broad chestnut-brown circum-columellar area.

A. meadi is most nearly related to the South African *Archachatina semidecussata* (Pfeiffer), *Archachatina drakensbergensis* (Melvill and Ponsonby), and *Archachatina semigranosa* (Pfeiffer),* with which it agrees in the outline of the shell and the bulbous shape of the apex. It is, however, smaller for the same number of whorls, with more convex whorls, which increase more rapidly in length. The decussation is less developed than in *A. semidecussata*, finer and more regular than in *A. semigranosa*, and decidedly stronger (particularly on the body-whorl) than in *A. drakensbergensis*.

Specimens Examined. TANGANYIKA TERRITORY: Ngosi Volcano in the Rungwe Mountains, holotype (M.C.Z. No. 182903) and 3 adult and 1 immature paratypes (M.C.Z. No. 81351); collected by Mr. A. Loveridge.

One of the paratypes was dissected by Dr. A. Mead from preserved material.

Measurements of Adult Shells

Length	Greatest	Aperture		Whorls	
	Width	Length	Width		
63 mm.	29.5	32.5	17	6½	Paratype
62.5	30	31	18	7	Holotype
62	26	31	14	6½	Paratype
60.5	28	32	16	6⅓	"

ARCHACHATINA (THOLACHATINA) WEBERI, new species

Pl. 8, fig. 1; Pl. 10, figs. 1 and 4; Pl. 20, fig. 1

Adult shell small, elongate-ovate but rather obese, widest below mid-length, the spire forming a very short, broad cone ending in a bluntly rounded apex; imperforate, moderately thick, solid, slightly translucent, dull. Whorls 6, decidedly and increasingly convex from the fourth on, separated by narrow, deeply impressed sutures; first flattened; upper three (including the nepionic shell) forming a broad, nearly hemispherical dome; remaining gradually increasing in length and width. Body-whorl long, fairly obese, about two-thirds of the total length of the shell in front view, decidedly more convex than penultimate whorl. Aperture semi-elliptical, short and wide, at most half the total length of the shell (usually somewhat less) with strongly but evenly curved outer margin. Inside white. Outer lip thin, sharp. Parietal wall with a slight, glazed, white callus. Columella white,

very narrow, nearly straight or slightly twisted, gradually narrowed over the basal third into a very weak, oblique truncation, ending close to the base of the outer lip. In a young shell, 13 mm. long, of 3 whorls (Pl. 10, fig. 1), nepionic whorls densely and finely granulose, except for the nearly smooth, or slightly wrinkled, earliest third of the first whorl; nepionic sculpture preserved in all adult shells seen, persisting even after weathering. Post-nepionic whorls coarsely decussate and in some examples (including the holotype) almost uniformly granulose; in some of the paratypes the granulations are more lengthened and welt-like on the upper half of the body-whorl; they become very weak or obsolete on the lower half of the body-whorl, which instead shows numerous, fine, somewhat wavy spiral engraved lines. On the 4th to 6th whorls, growth-striae coarser below the sutures; body-whorl often with a deep impressed line setting off a very narrow, irregularly crenulate, subsutural area. Periostracum very thin, pale straw-yellow, dull, readily worn off. Apical 3 whorls unicolorous, pale reddish-brown; remainder of shell yellowish with many fairly broad, straight, wavy or zigzag, reddish-brown streaks, narrowed toward the sutures, occasionally anastomosing. One paratype has the dark streaks very pale reddish and another is unicolorous straw-yellow.

A. weberi is related to the three species of *Archachatina* described thus far from Northeastern Africa: *A. stefaninii* (Connolly), *A. obtusa* (Connolly), and *A. neumanni* Thiele. It differs from all of these in the extremely weak, sometimes nearly rudimentary truncation of the columella. *A. stefaninii* and *A. neumanni* are also very different in shape. *A. obtusa* is similar in outline, but the aperture has a different shape, the thickened outer lip being somewhat shouldered before ending almost at a right angle on the parietal wall. The spire and particularly the dome-shaped summit are decidedly narrower in *A. weberi* than in *A. obtusa*.

Owing to the poorly developed truncation of the columella, one might be tempted to place *A. weberi* in *Limicolaropsis* (of which it has the shape) rather than in *Archachatina*. The relationship of *weberi* to *obtusa* (in which the columella is decidedly truncate) is so evident that I cannot but place both species in the same subgeneric division of *Archachatina*.

Specimens Examined. ANGLO-EGYPTIAN SUDAN: Imatong Mountains, 4° 15' to 4° 30' N., 32° 30' E., holotype (from below Lomuleng, 7400 ft.; J. G. Myers Collector.—M.C.Z. No. 182901); and 10 paratypes (6 immature), 6200 to 8700 ft. (N. A. Weber Collector.—M.C.Z. No. 182902). According to Dr. Weber this snail lives in the mossy rain forest and the *Podocarpus* stands.

Measurements of Adult Shells

Length	Greatest		Aperture		Whorls	
	Width	Length	Width			
52.5 mm.	28	26.5	14		6	Paratype
51	25	23.5	13		6	Holotype
49.5	26	24.5	12		6	Paratype
47	22.5	22.5	11.5		6	"
46	22.5	21	12		6	"

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